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THE SIGNALING SYSTEM OF THE BROADWAY AND SEVENTH AVENUE RAILROAD.

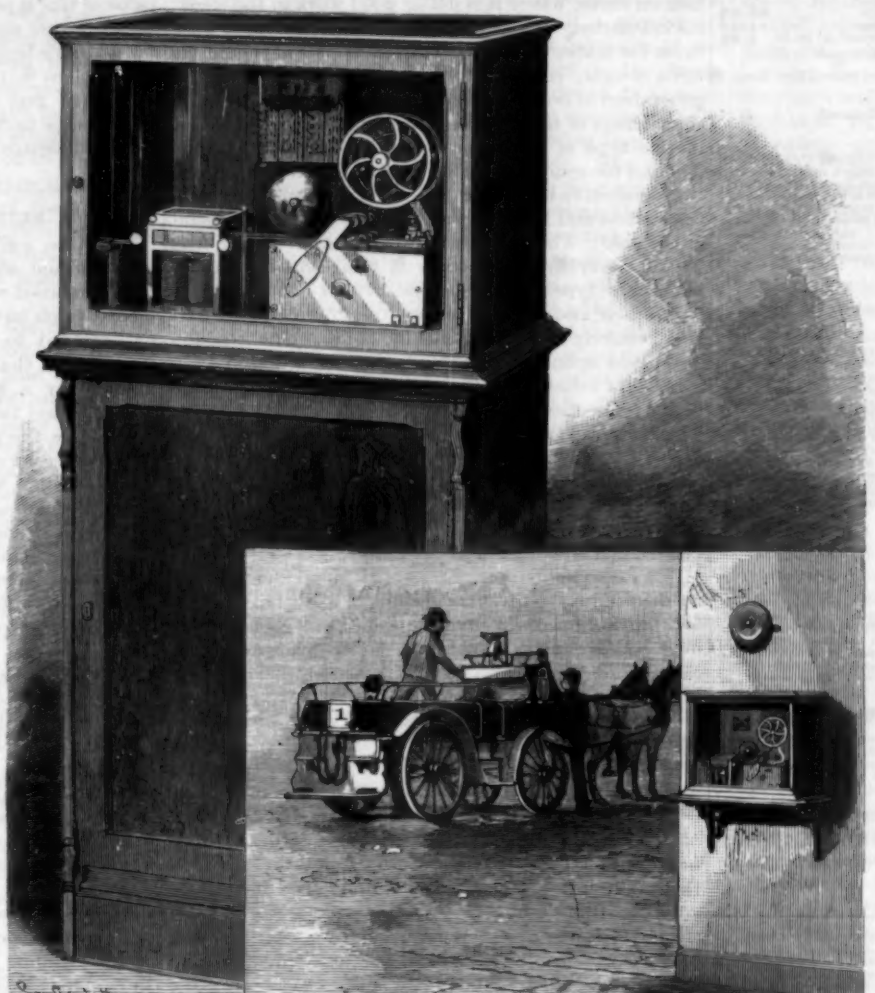
It goes without saying that a railway that must handle a half million passengers daily on one of the most crowded thoroughfares of one of the largest cities in the world must have some system of communication by which delays may be avoided, assistance rendered in case of accident, and by which provision can be made, in case of fire or other hindrance in the street, to resume and maintain traffic. There is no busier railroad than the Broadway and Seventh Avenue cable railroad, and while there is an occasional block, we venture to say that, although few roads do an equal amount of business, none of them operate with fewer delays. This, we think, is in a great measure due to the signaling system employed for communicating with headquarters.

The most frequent cause of delay is the breaking down on the tracks of heavy trucks and other vehicles, which cannot be readily removed and which require the assistance of the emergency wagon and its crew. Fire also frequently causes delays, but the railway company is often able by means of supports to run the hose at an elevation so that the cars may pass uninterruptedly. Occasionally the breaking down of a car or the failure of a cable causes a delay.

One of the more fruitful causes of accident and delay in the early history of the cable road was the fraying of the cable, and the stripping of a strand so as to form a large knot on the cable which the grips could not pass. In an accident of this kind the car was carried along with resistless force, carrying everything before it, with no chance of being stopped until a signal could be sent by some roundabout way to the power house to stop the cable. Pedestrians and all vehicles occupying the middle of the street were at the mercy of the runaway car. Nothing could be done but to give it a free course until the cable was disconnected or the engines stopped.

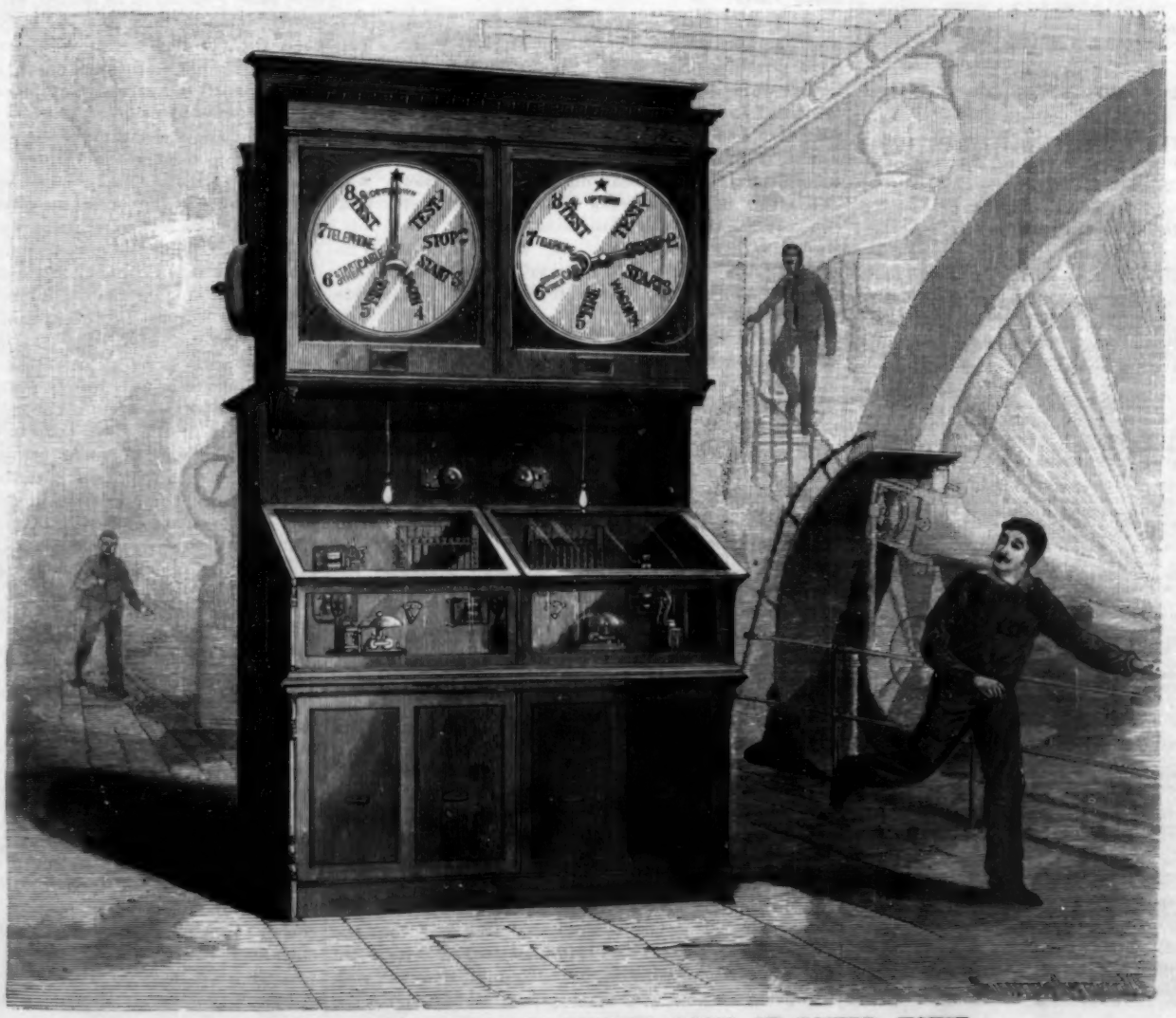
Now this and every other imaginable emergency is provided against so as to reduce the interruption to a minimum.

The electric signaling system of the Broadway and Seventh Avenue Railroad is illustrated in the annexed engravings, two of which show the indicators, alarms and registering apparatus at the power station, one showing the street signaling box, and another a diagram on which the circuits can be readily traced. Every section of the road has at least two signaling wires. An additional wire extends from Houston Street to Fiftieth Street, on Broadway, and three wires extend the length of Twenty-third Street and Lexington Avenue branch.



REGISTERING INSTRUMENT AND EMERGENCY WAGON.

In the engine rooms at the power station are placed indicators and alarms, and in the president's office is placed a recorder and time stamp, which makes a record of every call. The call boxes are placed in openings in the pavements, covered by heavy iron plates. They are inserted in the circuits and used in the same manner as in fire and district telegraphs, and they are each provided with a revolving lever and contact points corresponding with the words on the indicator at the power station. The call box has the same words arranged in the same order, so that when the lever is turned the circuit is opened and closed, causing a movement of the index in the indicator corresponding with the movement of the lever in the signaling box. At the same time the alarm gongs are rung, a record is made in the president's office, and the time is stamped on the record ribbon. An alarm is also sounded within the hearing of the men having charge of the emergency wagon, so that the wagon may proceed immediately to the location of the trouble. The wagon carries extras and tools, with a sufficient number of men to remove any ordinary obstruction or to make such repairs as are usually needed on the road. There are four such wagons, each carrying a force of men sufficient to cope with almost any trouble. One of the wagons is located at the Houston Street power house, another at Lexington Avenue and Twenty-third Street, the third at Ninety-ninth Street and Lexington Avenue, and the fourth at Fiftieth Street and Broadway.



INDICATORS AND ALARMS IN ENGINE ROOM OF POWER HOUSE.

Cards are furnished to the conductors, gripmen, and inspectors, giving the location of the boxes and other important items. Each box has an individual number. In case of an accident the conductor, gripman, or inspector uncovers the signal box in the street and sends an ap-

(Continued on page 6.)

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Contents.

(Illustrated articles are marked with an asterisk.)

TABLE OF CONTENTS OF

Scientific American Supplement

No. 1098.

For the Week Ending January 2, 1897.

Price 10 cents. For sale by all newsdealers.

THE WATER TUBE BOILER ON ITS TRIAL.

There has recently been brought to a close a series of trials of the water tube boiler, which has attracted more attention than any event that has happened in the engineering world for many months past. We refer to the trials of the 25,000 horse power installation of Belleville boilers on the cruiser Powerful.

These trials were remarkable, not because this was by any means the first use of water tube boilers at sea, but because it was the first attempt to use them on such an enormous scale. The public has long been familiar with this type as used on torpedo boats, and of late it has been winning its way into fuller recognition on shore, where it is doing good work in the general industries. It was natural that it should meet with favor for marine, and especially naval work, where its light weight, compact form and capacity for sudden generation of power render it specially useful. In the earlier days of torpedo boat building it had the locomotive type of boiler for its competitor; but as the demand for combined lightness and power has grown, the locomotive boiler has practically disappeared from the contest and left the water tube type in possession of the field. The excellent results obtained by the French navy in fitting some of their smaller cruisers with this type have led the British Admiralty to equip their two largest cruisers, the Powerful and Terrible, entirely with the Belleville boiler. The decision was based upon the French experiences, and also upon a series of exhaustive trials in one of their own gunboats. The decision evoked a storm of criticism from experts, naval and otherwise, and it was freely predicted that the attempt would be a costly failure. The results of the recent trials, however, are reported to have been exceptionally favorable, the contract horse power, 25,000, being largely exceeded, and steam being maintained with ease and regularity.

The Belleville boilers, forty-eight in all, are divided up into eight groups—four groups of eight boilers each and four others of four boilers each, each group in its own compartment. The four latter groups are arranged side by side and fired athwartship. The other four groups are arranged for fore and aft firing. There are twelve stoking spaces, arranged with four boilers and six stokers to each space. It is found that if the men replenish the fires every four minutes by the clock, perfect uniformity of pressure can be maintained.

It has frequently been urged that the results of official trials of foreign battleships are worth very little because they are of too short duration to really test the qualities of the machinery and boilers. It must be admitted that no such charge can be made in this case, the trial tests, indeed, being of an extraordinarily severe nature, such as have never been attempted in any other navy. They included two runs at 5,000 and 18,000 horse power respectively, each of thirty hours' duration, and a final run of eight hours, the first four hours at 25,000 horse power and the remaining two at 22,000 horse power.

In the first trial the average indicated horse power was 5,008 and the coal consumption 2·07 pounds per horse power per hour. Sixteen out of the forty-eight boilers were used. In the second thirty hour trial the indicated horse power was 18,433 and the coal consumption 1·83 pounds. The four hours' full power trial was carried out on November 27. The boiler pressure was 257 pounds; the mean indicated horse power was 25,886, the maximum being 26,497; and the speed of the vessel against a head sea and wind was 21·8 knots, the distance being measured by landmarks. The coal consumption was not taken. It was estimated that in smooth water the speed would have been about 22·75 knots.

During both thirty hour runs the two furnaces of each boiler were fired alternately at intervals of four minutes. At the commencement of the full power run this was reduced to three minutes. The fires were kept at a thickness of six inches, coal being put on only in sufficient quantities to fill up the holes and hollows. The draught plates were kept three-quarters open, the air supply being controlled by varying the speed of the fans. The Belleville system is run upon the "open" as against the "closed" system of forced draught, and the fans are used primarily for ventilation. The work of the ordinary closed stokehold fan is done in a Belleville boiler plant by air compressing engines, one of which is placed in each stokehold.

It will thus be seen that the introduction of the water tube boiler has removed at a stroke all the discomforts attendant upon the old forced draught. The maximum temperature in the stokehold never exceeded 90 degrees; in the engine rooms it was 75 degrees. It is claimed, and very justly, too, that this moderate temperature will be of inestimable value when the engine and boiler room staff is called upon to endure the long continued strain of a war cruise.

Some idea of the saving of weight which is made by the use of this type of boiler as against the ordinary Scotch boiler may be gathered from the fact that the Powerful can carry a coal supply of over 3,000 tons. On the other hand it must be borne in mind that the consumption of coal per horse power is higher for the water tube than for the common type of boiler. It is a common occurrence for a Scotch boiler to show a consumption of less than 1·5 pounds per horse power hour, and it was only the other day that, chancing to step aboard a tramp steamer and inquire as to her coal consumption, the engineer promptly responded by handing us the cards of the voyage just ended, which showed a consumption of 1·4 pounds. So that in considering the merits of the Belleville boiler as regards saving of weight, we must remember that if the weight of boiler per horse power is less, the weight of coal per horse power is greater.

Warships, however, are not run for economy. The value of this type of boiler lies in its power to generate high pressure steam rapidly and in great volume for a considerable length of time in response to an emergency call, such as will continually be made in active service. The trials just concluded prove that all these conditions can be fulfilled with an installation of the unprecedented capacity (for water tube boilers) of 25,000 horse power.

A RETROSPECT OF THE YEAR 1896.

It will be pardonable to take a rapid glance at the international affairs of the past year, before entering into a detailed recapitulation of the scientific achievements which have marked its progress; and, as a journal devoted to the arts of peace, we note with deep satisfaction that whereas the opening of the year was marked by a widespread international distrust and jealousy, and the gathering of ominous war clouds, its close finds the political sky growing clear, a more reasonable temper of tolerance and forbearance manifesting itself, and, with the exception of three widely separated corners of the earth, a prevailing and apparently long to be continued peace established. With the Venezuelan scare replaced by the prospect of a permanent peace tribunal; with England, France and Russia united in the effort to bring about reforms in the East; with the Boer government promising concessions to the foreign element in the Transvaal; with a satisfactory treaty concluded between Italy and Abyssinia and the hostages returned—the prospects of peace are certainly brighter now than they were in the opening days of the year which has just drawn to a close. The three existing wars are attendant on the struggle of Spain to hold what she has in Cuba and the Philippines, and of England to reconquer the Soudan.

It is encouraging to note that in the industrial world there is evidence of a marked revival of trade, which has been felt in every quarter of the globe, and in this respect is as widespread as the gradual depression which commenced in 1891. We were the last nation to feel the decline, and we have been among the last to show signs of recovery. With the opening of the year, however, we may congratulate ourselves that trade is thoroughly convalescent, and there is every reason to look for a prosperity which will be permanent, because it is more gradual in its return, and comes in a natural course. One of the most notable events of the year has been the astonishing development of Japan, whose victory over her traditional enemy seems to have awoke in her a spirit of aggressive ambition, which is showing itself in her evident determination to take her place as one of the leading nations of the world.

It was hoped when the Chinese statesman and ambassador, Li Hung Chang, made his tour through the western world at the time of the coronation of the Czar of Russia, that his return to China would be marked by a similar activity in the ancient empire. There is little doubt but what Li Hung Chang himself was earnestly in favor of introducing modern improvements and industries. The tidings, however, that soon after his arrival he had been again degraded shows that the conservative party is yet all powerful. The awakening of China seems to be indefinitely postponed.

The most notable event in the field of engineering was the opening of the river Danube to navigation. This event formed part of the millennial festivities in Hungary, and as such took rank with the great exposition at Buda-Pesth. The undertaking was intrusted to Hungary by the treaty of Berlin, 1878, and work was commenced in 1890 and completed on the last day of 1895. The blasting operations covered a distance of sixty miles, and involved the removal of 1,635,000 cubic yards of material, 915,600 of which were excavated under water. Nine thousand workmen were continuously employed and the total cost was $10,000,000. Previous to the opening of the Iron Gates five feet was the limit of draught for river steamers for a large part of the year. The canal now affords an unobstructed outlet from Vienna to the sea for boats drawing ten feet of water. The Nicaraguan Canal Company states in its annual report to the Secretary of the Interior that no work has been done since August, 1893. Its rival, the Panama Canal, is almost equally inert, a small force being employed merely to fulfill charter obligations. It is with pleasure we turn to the Chicago Drainage Canal, which is being pushed with commendable energy. Apart from its magnitude, this work is remarkable for the magnificent excavating machinery which it has called into existence and the novel methods of handling material which are employed. The pre-

liminary operations connected with the great Simplon Tunnel through the Alps are under way, and the fact that this monumental work is being undertaken conjointly by the Italian and Swiss governments is a pledge of its vigorous prosecution. In this country we have seen the completion of the great dry dock at Port Orchard, 675 feet long, and a similar structure at the Brooklyn Navy Yard, with a length of 670 feet, is within measurable distance of completion. Work has been carried on without interruption on the Croton River Dam, and this massive structure is, therefore, nearer completion by one more out of the total thirteen years that will have been consumed in its erection. Work has been commenced during the year on the new East River Suspension Bridge, New York. This structure will rank as the second longest railroad span in the world, the clear length between towers being 1,600 feet. It will carry six lines of railroad track, two roadways, and two footwalks, and will in every way, except that of beauty, eclipse the existing New York and Brooklyn Bridge. Mention should be made of the completion of the great Cascade Locks on the Columbia River, Oregon, whereby a vast area of the interior of the State is opened up to river navigation, of the progress of the great lock at the new Imperial Harbor of Bremerhaven, and of the extensive works at Barry Docks, England.

In the wide field of transportation, the most notable undertaking is of course the great Siberian Railway. Work has been pushed so vigorously that the line will soon reach Irkutsk, an event which will mark the completion of the entire western, and a large part of the transcontinental, line. At the present rate of construction, the line can be completed in 1898. Considerable activity is being shown in railroad building in Southeastern Africa, and the Congo Railroad is about half completed. In the United States, 1,803 miles only were built last year, a small figure in comparison with those of previous years; but it must be borne in mind that a vast amount of work has been done in the improvement of roadbed and rolling stock. The past year has not been marked by any such spectacular railroad runs as distinguished its predecessor; but there has been a tendency to accelerate the running speed of the average train. This has been rendered possible by the improved condition of the track and the ever increasing weight and power of the engines. The favorite type of locomotive for fast passenger traffic, if we may judge from the recent examples, has cylinders 19 to 20 inches diameter by 24 to 26 inches stroke; 180 to 200 pounds of steam; drivers, 6½ to 7 feet in diameter, and about 2,000 square feet of heating surface.

Electric traction has continued to make steady progress during the year. Its ultimate application to the trunk railroads has been brought a step nearer by the excellent results obtained during the year on the Nantasket branch of the New Haven road, which have been so good that the company has determined to lay a third rail on other branches of its system. Of the attempt to apply electric traction to the main lines by the builders of the Heilmann locomotive, it can only be said that if it proves to be successful, it will be in flat contradiction to the commonly accepted principles of the conversion of energy. The company claims to have been so encouraged by results that they are building larger and much more powerful machines. The successful operation of the Lenox Avenue underground trolley lines in New York City during the snows of last winter, and the determination of the company to put in the same system on forty miles of their horse car lines brings the day a little nearer when overhead wires will be abolished from our streets. The year has seen the opening of the Buda-Pesth electric underground road in Europe, and in this country the Boston Electrical Subway has progressed favorably. The deep underground electric railways of London have proved so successful that several new schemes are in progress and proposed. The Snaefell Mountain Railway in the Isle of Man has scored a brilliant success for electric traction, in sharp contrast to its unfortunate contemporary across the channel in North Wales, the Mount Snowdon steam rack railway. Much interest attaches to the line opened this year at Lugano, Switzerland, where the three-phase system receives its first application to traction. The cars carry a double trolley and the rails are utilized as one conductor. Limits of space prevent a detailed reference to the ever increasing applications of electric power, chief among which is the transmission from Niagara to Buffalo. Suffice it to say that the year has seen its further extension in the shape of electric locomotives for mining and general yard work, its extended application to elevators, motor carriages, the manipulation of warship appliances, artillery, to various household uses and a multitude of other purposes.

Compressed air, notwithstanding the loss of power inseparable from its compression and expansion, has come to the front this year, especially in this country, where the Hardie and Hoadley patents for railway motors have been extensively tested on the streets of New York City. Both of these attempt to overcome the loss by a system of heating the air previous to its admission to the cylinders. The Hardie motor has given such satisfaction that it is shortly to be applied experimentally to the elevated railroads in this city. Compressed air has also undergone a successful test on the United States monitor Terror, where it is applied to the manipulation of the turrets.

The motor car, or horseless carriage, has attracted more attention this year than any other device in the field of mechanical engineering, always of course excepting the bicycle. Our columns have kept the public well informed, both by cuts and descriptive matter, of the progress of the industry. The record of the year proves that the motor car has come to stay, and gives cause to believe that it will enjoy a popularity second only to that of the bicycle itself, and a commercial utility far greater. The greatest performance of the year was that of the winning machine in the Paris-Marseilles race, which covered 1073 miles at an average speed of over 15 miles per hour. In this country we have had the Cosmopolitan race on Decoration Day and the track race at the Providence State Fair. The way has been opened for the new industry in England by the repeal of the antiquated laws restricting the use of motors on common roads. In the inaugural parade (so called, it was really a race) the winning car made a speed of over 20 miles per hour for the whole journey from London to Brighton. At present the oil motors are in almost undisputed possession of the field; but there is every reason to expect that when the steam engineers have had time to develop a suitable form of engine and boiler, this supremacy will be disputed.

The bicycle still continues to enjoy an enormous popularity. It has undergone little or no organic change this year in its construction; the diamond frame, chain-driven machine continuing to be the practically universal type. There is a tendency to raise the gear from 66⅔ to 74 or even 80. The tendency to study the comfort of the rider is seen in the great attention which has been paid to the production of a comfortable saddle, built on so-called "hygienic" principles. The single tube tire appears to be displacing the double tube; and the weight of the average machine remains at about 23 pounds.

The close of the year 1896 sees no abatement in the craze for naval shipbuilding which has taken possession of the nations. England, France and Russia continue to make enormous expenditures on their fleets, and Germany, on a smaller scale, is maintaining her activity of the last few years. Speaking generally of the designs, there is a tendency to sacrifice armor to armament and speed. This is very noticeable in the latest battleships of the English navy, known as the new Renown class, which, with a displacement of nearly 13,000 tons, will have only eight inches of armor on the sides, six inches on the bulkheads and ten inches on the turrets. On the other hand, they will carry nearly 2,000 tons of coal and steam about nineteen knots. It will thus be seen that the dividing line between battleship and armored cruiser is gradually disappearing. One of the most sensational events of the year was the speed attained by the torpedo boat destroyers Desperate, of the British navy, and Forban, of the French navy, both of which exceeded thirty-one knots an hour. The naval progress of the United States during the past year has been altogether unprecedented. The most notable fact is the completion of that powerful trio of battleships, the Indiana, Massachusetts and Oregon, which are universally conceded to be the most powerful fighting machines afloat. Each of them considerably exceeded the contract speed at its trial, the Oregon touching seventeen knots an hour. The Brooklyn was nearly two knots ahead of its trial speed of twenty knots, and this vessel also enjoys the distinction of being the most effective ship of her class afloat. The monitors Monadnock and Terror, the ram Katahdin, and the torpedo boat Ericsson have also been accepted. In naval strength, the United States have now moved up to sixth place, and they will eventually be ahead of Germany on the list, if the present activity continues.

We have so recently illustrated the recent developments of shot and armor that it is sufficient to say that the year closes with the Harveyized reforged nickel steel plate and the compressed fluid steel solid shot of American manufacture still in the lead.

In the merchant marine it is gratifying to record that the American liner St. Paul has captured the record from Southampton to New York, her time on two successive trips being 6 days 2 hours and 24 minutes, and 6 days and 31 minutes, her speed on the latter trip being 21·08 knots per hour. This result from a ship which was designed for only 20 knots is a distinct tribute to the skill of the shipbuilders. Mention must be made in this connection of the placing of orders by the Japanese government with Messrs. Cramps and with the Union Iron Works for two fast cruisers. It is the first event of its kind, and full of promise for the future. Speaking generally, there has been a tendency the past year to build cargo steamers of unprecedented size, huge carrying capacity and moderate speed, the Pennsylvania, the next largest ship to the Great Eastern, and rivaling her in size, being a case in point. The German yards have two vessels in hand for the Atlantic mail service which are to surpass the Lucania, the Frederick the Great being 20 feet longer on the waterline and several hundred tons greater displacement. The world is watching curiously for the trial trip of the Bazin roller ship.

The geographical world has welcomed home this year from Arctic exploration Dr. Nansen, who failed to drift across the North Pole, but penetrated to latitude 86 degrees 14 minutes, which is 2 degrees and 30 minutes further north than ever before attained. The Jackson-Harmsworth expedition has mapped out an extensive area of Franz Josef Land, and Lieutenant Peary has returned safely from his annual Arctic trip. The voyage of Mr. Borchgrevink to Antarctic regions and his earnest representations are likely to result in one or more well equipped expeditions.

Archæology has reaped a rich harvest as the result of the year's explorations. M. De Morgan's discoveries at Dashur in Egypt, the excavations of Dr. Richardson in Corinth and Herr Dorpfeld at Athens, the finding of Trajan's Ship of State in Lake Nemi, and lastly the splendid results of American investigation in Babylonia are only some of the operations of a particularly successful year.

The field of aeronautics is poorer by the loss of Lilienthal, who died a martyr's death, victim of his devotion to science. The most remarkable performances of the year have been those of Prof. Langley's aerodrome, which, carrying its own fuel and water, has soared and returned to earth, and also flown 1,500 yards in a horizontal direction, without losing its equilibrium or receiving any damage. The feat of human flight has been successfully accomplished for varying distances by inventors who have followed in the steps of Lilienthal, who was the first to accomplish it successfully. Experiments in kite flying have been industriously prosecuted at the Blue Hills Observatory, Boston, and this quondam pastime is likely to be turned to good meteorological account.

By far the most dramatic event in the world of science occurred when the year was yet but a few days old. On January 4, at the celebration of the semi-centennial of the founding of the Berlin Physical Society, Prof. Roentgen announced his discovery of what are now universally known as the X rays. A certain form of vacuum tube was shown to be capable of giving out rays which could penetrate opaque substances, and the public incredulity was quickly dissipated when X ray photographs began to fill the columns of the illustrated press. Following close upon the announcement came the fluoroscope, which enabled the effect of the rays to be seen directly by the eye. If no other event than this one had to be chronicled, the year just closed would stand out as one of the most famous in the history of Science.

The Pyro-Metol Developer.

BY JEX BARDWELL.

Some weeks ago I had a call to do a little street photography. The day was very far from being suitable for snap shot work, but it had to be done then or not at all. It had been raining, so that the atmosphere was clear, but there was very little light. The lens I used will work at *f*/4, but in order to get better distance I used the stop *f*/8. It was with some fear that I entered my dark room to develop the plates, but I had the satisfaction of having them turn out all right. I attribute my success to a modified pyro or pyro-metol developer which I have employed for some time past with general satisfaction. Those who have a little time to spare, and who are fond of trying a new thing once in awhile, will possibly find these few notes of interest. In the following formula No. 1 is for use when it is desired to produce a strong negative; No. 2 is a milder form of the same; No. 3 is the usual alkali solution:

No. 1.

Water	8 ounces
Metol	18 grains
Sulphite of sodium (cryst.)	360 "
Pyro	22 "
Bromide of potassium	4 "
Citric acid	24 "

No. 2.

Water	8 ounces
Metol	18 grains
Sulphite of sodium (cryst.)	360 "
Pyro	22 "

No. 3.

Water	8 ounces
Carbonate of potassium	1 "

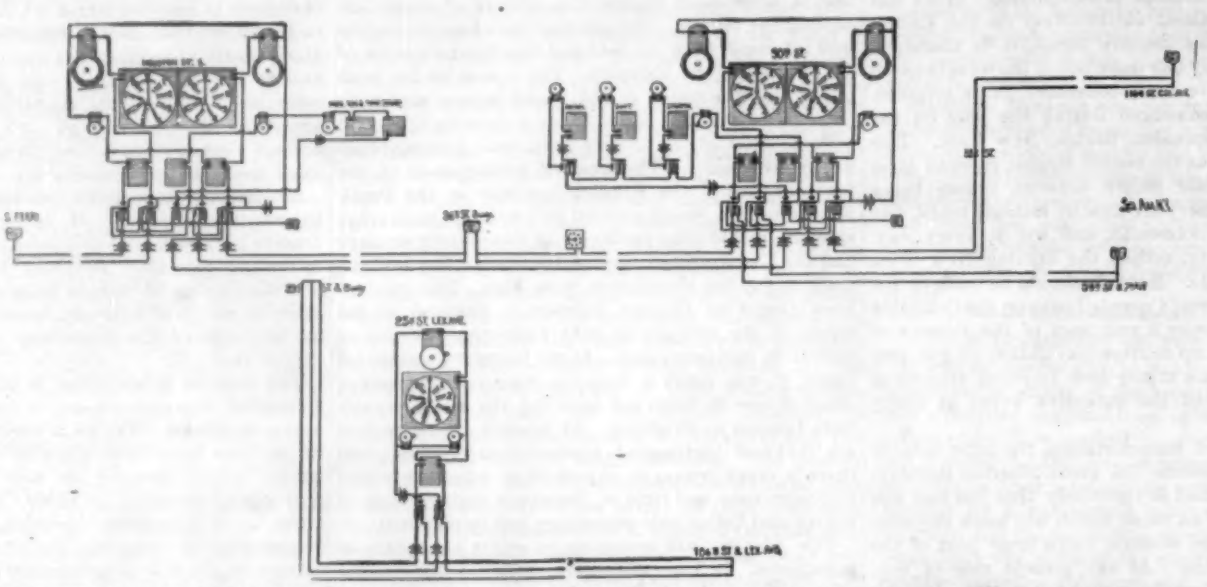
For use, take one part of No. 1 (or No. 2 according to the kind of negative desired) to one part of No. 3, and add one part of water.

I find that the above quantity of sulphite gives a slight tint which produces an excellent printing negative, but if you desire a gray negative you can get it by increasing the quantity of sulphite. I think those who try it will like it. I have had better results with this formula, both under skylight and landscape, than with any developer I have ever used. You can modify the printing qualities of your negative to almost any extent by increasing or decreasing the quantity of sulphite.—Wilson's Photographic Magazine.

THE SIGNALING SYSTEM OF THE BROADWAY AND SEVENTH AVENUE RAILROAD.

(Continued from first page)

propriate signal which will stop the cable or send out the wagon, as the case may be. If the cable is to be stopped, the index points to stop on the dial; the gong sounds the alarm, and there is for the moment great activity in the engine room, where the men rush for the throttle valves and shut the steam from the ponderous engines, or disconnect the cable drums by operating the clutches. If there is an obstruction on the track, like a broken down truck, for example, the wagon is signaled for and the men jack up the truck, attach a false wheel (which they carry and which is like a sleigh runner) and remove the truck from the track. When the track is again clear a signal is sent which indicates that the engines are to be started. Telephone connections are provided, so that conversation may be carried on between the power station and any point on the road.



ELECTRICAL CONNECTIONS OF SIGNALING SYSTEM, BROADWAY AND SEVENTH AVENUE RAILROAD.

The Mother Lode.

BY ENOS BROWN.

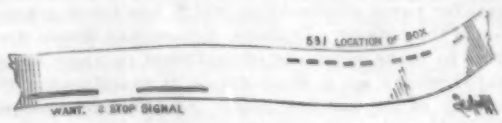
The term "Mother Lode" is a designation of the early miners of a vast mineral deposit of gold bearing quartz veins of a definite character occupying a central position in the great auriferous slate belt identified by Prof. Whitney, and extends in a northwest and southeast direction through the foot hills paralleling the Sierra Nevada Mountains which form the eastern boundary of the State of California. It begins in Mariposa County and runs northerly through Tuolumne, Calaveras, Amador, Eldorado and Placer Counties. North of Placer County it becomes less well defined, but appears in portions of Nevada, Butte, Sierra and Plumas Counties. In these ten counties most of the gold produced in California has been extracted. The Mother Lode proper, however, includes a region about one hundred miles in length from north to south, with a width ranging from five to fifty miles, with an average altitude of 2,000 feet, and constitutes the largest, richest and most remarkable metalliferous deposit of precious metals known in the world.

In this district is found a large number of gold bearing quartz veins irregularly distributed and interrupted by sterile and unproductive areas which usually occur in a belt of black slate with either slate, diabase, serpentine and occasionally granite as wall rock. In these veins is generally found a peculiar green vein matter which has been considered as characteristic of this auriferous belt and has received the name of mariposite, from the fact of its being found so abundantly in Mariposa County.

The veins of this region are also considered more reliable from the fact that they have proved, in some cases, to be rich at a depth of 2,000 feet, and consequently permanent producers.

The largest and most important gold mines in California are located in this belt, the Church, Plymouth, Eureka, Keystone, Morgan, Utica, Rawhide, Josephine, Sanisby, Idaho, Empire, Kennedy, Princeton, Sheepranch, Providence and others with their record of millions. From observations of geologists it would appear that the origin of this vast reservoir of mineral wealth in all probability was that, at the time of the upheaval of the Sierra Nevadas, and the consequent disruption and tilting of the adjacent rocks, a series of fissures were formed which were subsequently filled with quartz and other mineral matter by alkaline water at a high temperature. Alkaline solutions at a high temperature and under great pressure will dissolve large amounts of quartz, which is deposited in a crystalline state on the cooling of the solution. This process is still in operation in the State, and there is nothing improbable in this theory when the unnumbered centuries occupied in these geological changes are considered. But how did the gold get there? This is a question that has puzzled scientists exceedingly and has been the subject of much profound investigation. A large proportion of the gold found in the quartz veins of the Mother Lode is in an exceedingly fine state of division and in intimate association with sulphur and pyrites. A good deal of it is, however, free and disseminated through the rock, from which it can be separated by pulverizing and carefully washing the resulting powder with water, leaving the gold behind.

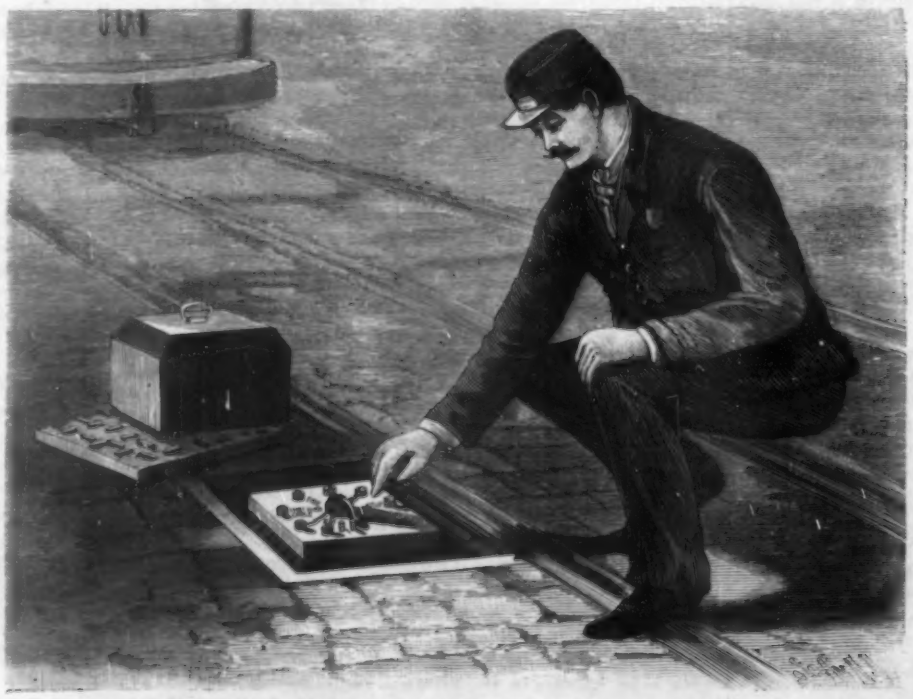
This fine gold might have been carried into the



THE RECORD STRIP.

quartz mechanically at the time the fissures alluded to were filled with the quartz they now contain, but theory would not account for the large masses or pockets which are often encountered and whose formation has been explained by some scientists as due to electric currents which we know exist in the earth's crust, bringing the small particles of gold together from surrounding rocks. It is also probable that the element called tellurium has had much to do with the deposition of gold in the veins of quartz. Tellurium is a volatile element which sublimes at a low temperature and carries the gold with it. In all probability it has had much to do with the depositing of gold in these mines.

The hope of California as a gold producing section lies in the development of the Mother Lode. From only a few mines within a limited territorial range it is producing $10,000,000 annually. Its area is mostly maiden ground which only waits the effort of labor backed by capital and intelligence to make it the richest gold producing territory in the world. The lode has produced in the past hundreds of millions of dollars and the future is bright for it. In every portion of the lode can be found groups of prospectors searching diligently for indications, and results are sure to follow. Railroads are being projected to pierce the region of the Mother Lode and to make it accessible without laborious effort. The owners of the Mariposa grant have announced their intention to develop that rich section and to reopen the mines which heretofore have produced such quantities of rich ore. All is activity on the Mother Lode, and the people of California view with much complacency efforts which they fondly expect will bring to them again the flourishing days of old.



STREET SIGNAL BOX—SIGNALING POWER HOUSE.

Tiny Little Brains.

Dr. William A. Hammond, the celebrated neurologist, says the ganglia, which run like little threads of silk throughout the body, are tiny little brains, largely made up of the same kind of gray matter that composes the thinking part of the brain. While the sensitive ganglia send their little tendrils into every portion of the body, there is an especially large amount of them about the heart, and, really, according to Dr. Hammond, the human heart actually thinks on account of it. When we are frightened, the heart almost stops beating.

How could it do it, unless it really thought? It would be impossible.

The heart brains are the little gray ganglia, and they recognize the emotions of joy or pain or fright by sending quick throbs and thrills through the heart, which Dr. Hammond calls a secondary brain. It is well known that the ancients believed different organs of the body to be possessed of mental attributes, and this idea has been handed down to us in such expressions as a "brave heart," a "noble heart," a "splenetic nature," and the like.

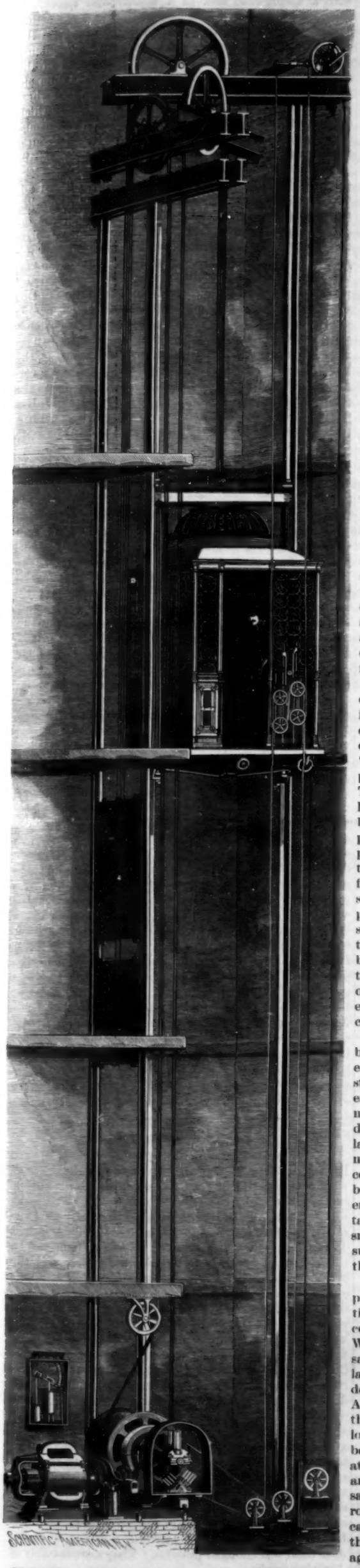
Crossgrained people are said to have their spleens out of order, and the ancients located anger, resentment and impatience in the spleen.

An immense amount of gray matter or tissue runs back of the stomach, and a heavy blow there will kill as quickly as if the brain itself had been struck.

Wherever the ganglia congregate is a vital spot, and instead of thinking solely with the gray matter that is within our skulls, we think in every important organ and throughout every prominent function within our bodies. So says Dr. Hammond, and science, adds the New York Tribune, seems to agree with him.

The St. Elmo's Fire.

In the June number of the Annalen des Hydrographie there is an interesting discussion by H. Haltermann, of the occurrence of St. Elmo's fire at sea, based upon observations in the log books received at the Deutsche Seewarte. The tables contain full details as to position, conditions of weather, etc. During more than 77,000 days of observation the phenomenon was observed 164 times, 87 times in north and 77 times in south latitude. Its occurrence differs very considerably in different parts of the ocean—e. g., in the ten degree square lying between the equator and 10 deg. N. lat. and between 20 deg. and 30 deg. W. long., St. Elmo's fire was observed about three times per 1,000 days, while in the two squares lying between 50 deg. and 60 deg. S. lat. and 60 deg. and 80 deg. W. long. it occurred six times per 1,000 days. The more frequent occurrence at sea than on land is attributed to the fact that the accumulating electricity is more easily conducted by the numerous objects projecting into the air over the land.



ELECTRIC ELEVATOR FOR FIREPROOF BUILDINGS.

THE LATEST IMPROVEMENTS IN ELECTRIC ELEVATORS.

The adaptation of electricity to the working of elevators in buildings has been watched with great interest, and the fact that electric elevators are now achieving a marked degree of success, and coming largely into use, is looked upon with great favor by the public. The large illustration on this page shows a high grade electric passenger elevator for fireproof buildings, the only combustible material used in it being the floor of the car. The motor is anchored to a brick foundation in the basement, and takes up but little space. This class of machine is built by the Elektron Manufacturing Company in sizes ranging from 5 horse power to 20 horse power, for speeds ranging from 40 feet per minute to 200 feet per minute and for capacities from 2,000 pounds to 5,000 pounds. In the small illustration is shown a machine for speeds ranging from 10 feet per minute to 100 feet per minute and capacities from 10 pounds to 500 pounds, while still smaller and larger machines are made.

These elevator machines are of the "worm gear" class, by perfecting the design and workmanship of which high efficiency and smooth running have been secured, the efficiency of the passenger gears being proved to be over 75 per cent. The drum, gearing, motor and switch are all mounted on one heavy cast iron bed plate. The gear is of gun metal, with teeth accurately hobbed from the solid, and the worm and worm shaft are made from one steel forging accurately turned in the lathe. Both gear and worm run in an oiltight case or housing, which also contains the bearings. The electric motor is coupled direct to the worm shaft by a heavy insulated coupling, which also serves as a brake wheel. The motors are constructed especially for elevator work, having great starting power, high efficiency and durability. They are heavily insulated from all other parts of the machine, thus obviating all danger of a shock to the operator in the car.

The plant illustrated is what is known as a "six cable job," there being two wire cables from the winding machine to the car; two from the car to the car counterweight and two from the machine to the machine counterweight. By this means it is possible to "overbalance the car," and it is found that the best practice is to overbalance equal to the average load. The sheaves over which the cables run at the head of hoistway are of cast iron, with steel shafts running in babbitted self-oiling bearings. These bearings are supported by heavy steel beams, which are in turn supported on the walls of the building. The guides for the car and counterweight are of planed tee iron, with fish plates at the joints, making a perfectly smooth and straight track for the car. The frame of the car is composed wholly of steel channel beams. The cables and safety devices are all attached to this frame, relieving the car of all strain. The car itself sets upon the two bottom beams of the frame and is strongly braced to the side beams. The car, as will be seen, is of highly ornamental iron work, and is usually provided with electric light chandelier and with electric annunciator connected to call buttons at each landing.

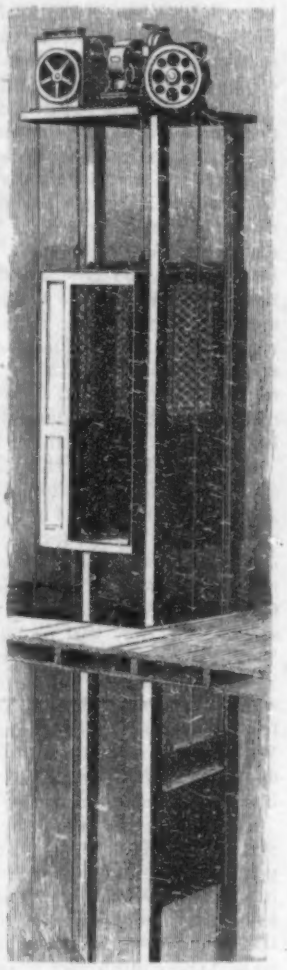
As shown in the illustration, the control of the car is by hand wheel, but where preferred on moderate speed elevators the straight hand rope is used. The starting, stopping and reversing is accomplished with the greatest ease and smoothness. The switch, which is shown mounted on the operating sheave at one end of the drum, is very substantial, and, being mounted on a large radius, moves very rapidly as compared with the movement of the operator's hand; it also breaks contact with a pronounced snap. Troubles with the burning of switch contacts have in this apparatus been entirely avoided. The automatic rheostat is shown attached to the wall back of the machine and insures a smooth start and prevents blowing fuses, no matter how suddenly the operator may throw in the switch.

In the construction of the passenger elevator, the question of safety has justly received the first consideration. What may be styled the "car safeties" are shown in the large illustration, and also in detail at the bottom of car. An endless rope passes over the governor wheel, which is located on the overhead beams, around an idler wheel at the bottom of the hoistway and several times around the safety drum on the car. This rope is, by a spring pressure, caused to move normally with the car. In case of the breakage of the lifting ropes, or in case of excessive speed due to any cause, the centrifugal governor operates a clutch which stops the movement of the rope. As the car continues to descend, the safety drum is caused to revolve, applying a gradually increasing vise grip to the steel guide rails on either side and bringing the car to a gradual stop. The machine also has a complete line of safety devices, as shown in the illustration of the switch and brake mechanism, where may be seen the attachment of the two switch knives directly to the operating sheave. This sheave is loose on the drum shaft and is rotated by the wire rope from the car at the will of the operator. The inner hub of the sheave carries a cam which moves the bell crank lever, raising and lowering the lever of the brake, and the instant the switch knives break contact with the clips the brake is applied.

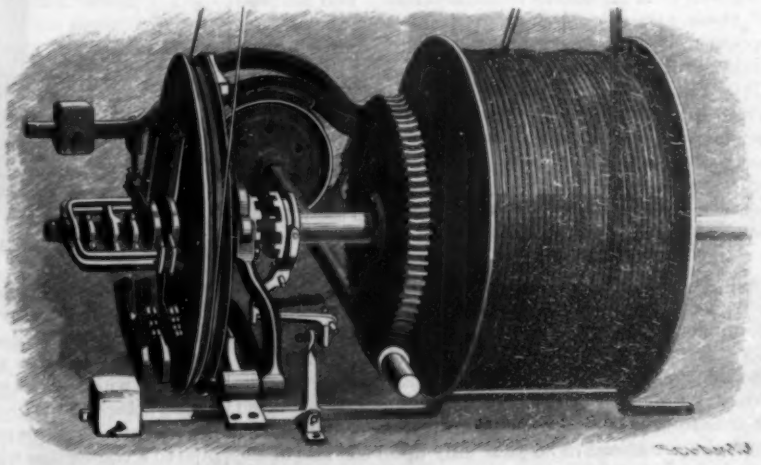
THE AUTOMATIC SAFETY CAR STOP.

One of the most important "safeties" is what is called the slack cable safety, also shown in the same view. A bar is located just below the drum and so close to it that there is barely room for the cables to run between when they are taut. If for any reason the cables should become slack, the bar is tipped downward, tripping a catch and allowing the coil spring to slide forward a clutch on the drum shaft into connection with the operating sheave. A slight additional rotation of drum will carry the sheave sufficiently to open switch and apply brake and stop the machine.

The automatic terminal stop consists of a screw threaded extension of the drum shaft outside of the operating sheave and of a frame or yoke connected with the operating sheave which surrounds the same. On this screw are two stationary nuts and one traveling nut so adjusted that when the car reaches either terminal the nuts will engage, and the operating sheave will be caused to rotate with the drum, when a slight rotation is all that is necessary to open the switch, apply the brake and bring the apparatus to a stop. The elevators are manufactured by the Elektron Manufacturing Company, of Springfield, Mass., with branch offices at New York City, Boston, and Rochester, N. Y. This company were among the first to adapt electricity to elevators, and they make direct elevators for both freight and passenger service, ranging in speed from 10 feet per minute to 300 feet per minute, and in capacities from ten pounds to ten tons.



A PRIVATE RESIDENCE ELEVATOR.



THE BRAKE SWITCH AND AUTOMATIC STOPS ON THE MACHINE.

Science Notes.

Mr. Igi, of the College of Science, says the Japan Weekly Mail, of Yokohama, is assured from data that he collected during a recent tour of investigation in the Sanriku district, that the seismic wave of June was due to a submarine volcanic explosion. He places the center of the disturbance about 200 leagues east off the coast of Yoshihama, Kisen district, corresponding to 39° lat. N., 149° long. E. He thinks that the phenomenon was similar to the Krakatoa disaster, save that instead of the volcano being on land, as in the East Indian catastrophe, in this instance it was far beneath the surface of the sea. He says that the temperature of the sea in the neighborhood has been raised 3° above that prevailing in ordinary years.

The number of students in German universities last summer is reported, says Science, to have been 29,802; in 1895 it was 28,709, so that the numerical increase for the present year is 993, or 3·5 per cent. The distribution of the students among the various universities was as follows: 4,649 in Berlin, 3,777 in Munich, 2,876 in Leipzig, 1,863 in Bonn, 1,425 in Breslau, 1,415 in Halle, 1,379 in Freiburg, 1,339 in Wurzburg, 1,172 in Tübingen, 1,164 in Heidelberg, 1,138 in Erlangen, 1,007 in Göttingen, 965 in Marburg, 948 in Greifswald, 938 in Strassburg, 761 in Jena, 708 in Kiel, 700 in Königsberg, 630 in Giessen, 500 in Rostock, and 420 in Münster. The number of students at Vienna was 2,238, but only 1,870 of these were regular students.

M. Moissan has recently carried on certain new experiments relating to the preparation of the diamond. He says: "A new combustion was made of diamonds prepared in part by means of small cylinders filled with charcoal of sugar, and partly by means of metallic blocks of iron and copper. These two procedures furnished the purest diamonds. They sank in methylene iodide, scratched rubies with ease, and contained no black diamonds. The weight of the diamonds was 5·7 mgrm.; when burnt, they left a trace of ash, the weight of which could not be appreciated with the balance. We collected 20·5 mm. of carbonic acid. Theory requires for 5·7 mgrm. 20·9 mm. This substance responds to the fundamental property of carbon, yielding for 1 grm. of substance 3·666 grm. of carbonic acid."

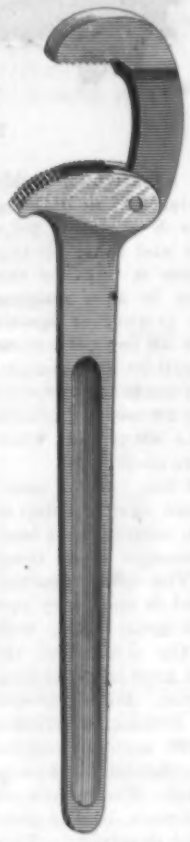
Lieut. De Gerlache, the leader of the projected Belgian Antarctic expedition, says that it will start from Antwerp about July 15 next. The steamer Belgica will carry a three years' supply of provisions, and will probably be absent about two years. During the first year the expedition will go to the east of Graham Land in George IV Sea, and then winter in Australia. The second year they will probably go in the direction of Victoria Land. "We intend," the lieutenant says, "more especially to devote ourselves to geological and zoological research, taking for this purpose specimens from the various sea depths and the submarine deposits. We shall also estimate the sea temperature at different depths, and, in short, make researches similar to those by the Challenger and other Antarctic expeditions."

The ordinary pictures and diagrams of icebergs—even those that occur in standard text books—are impossible and absurd, according to Mr. Goode. He says, in a letter to Science: "When we stop to think that an iceberg is merely a floating piece of ice, free to move in the mobile liquid water, we shall see at a glance that, to be in stable equilibrium, the shortest dimension must be vertical. A berg as large as shown in some of these amusing cuts could not be kept in position by a whole fleet of great ships with grappling hooks and cables. It is true that in some cases the artist has fitted blocks of stone into the ice near the bottom. But this has been done, very probably, to show the ice as an agent in transportation, and not in any case has he put ballast enough there to hold the berg down." The writer gives a list of some standard works that contain these false and misleading pictures.

The republic of Venezuela has granted a concession to the National Association of American Manufacturers, whereby the latter, on behalf of the manufacturers of this country, are authorized to erect in the cities of Caracas, Valencia, Maracaibo, and Ciudad Bolivar, buildings or museums for the permanent exposition of all goods from American manufacturers. The purpose of these expositions is to give the Venezuelans an opportunity of formally inspecting and comparing our goods with those of the old world. Consul Plumacher, United States consul at Maracaibo, says that England, France, and Germany overrun South America with commercial traveling agents, mostly energetic young men, well versed in the Spanish language and customs of South American people, but that a commercial traveler for an American house is seldom seen in the country. The American association very properly argued that permanent expositions are far cheaper than employing traveling agents, and it is expected that the arrangement which has just been consummated will be of great benefit to manufacturers of this country. In order to facilitate these expositions, the Venezuelan government has agreed that all goods from this country for either of said expositions shall be admitted free through the custom houses, the regular duties upon importations to be paid only upon the sale of the goods imported.

AN IMPROVED PIPE WRENCH.

The simple, strong, self-adjustable tool shown in the illustration forms the subject of a design patent recently issued to W. T. Johnston, and manufactured by W. T. Johnston & Company, of No. 32 Cortlandt Street, New York City. It is a strictly high-grade tool, made of the best drop forged steel. There are only three pieces or parts in the tool, all strong and well proportioned, and the facility with which, from the special formation of the jaws, it may be made to engage and firmly grasp any size of pipe within its capacity is apparent at a glance. There are two sizes of teeth in the fixed jaw, the coarser outer and the finer inner teeth of which also aid in enlarging the usefulness of the tool. The wrench is made in various sizes, and size No. 16 takes from one-quarter inch pipe to one and a quarter inch pipe, a wide range of duty for a tool so readily applied.



THE JOHNSTON PIPE WRENCH.

Neglected Drugs.

On the analysis of 27,000 prescriptions recently made by Prof. Patch, President of the American Pharmaceutical Association, it was shown that the pharmacopœia was sadly neglected by physicians. Only seventeen vegetable drugs were prescribed, and more than 100 drugs of vegetable origin neglected. Ten metals were honored, but more than ten were left out in the cold. In the study of 217,000 prescriptions from nineteen drug stores distributed in Chicago, Philadelphia, Bayonne, New York, Boston, Washington, Baltimore, Denver, San Francisco, New Orleans, Cincinnati, and St. Louis, 11·25 per cent were proprietary articles, not including many elixirs, pills, tablets, fluid extracts, etc. which were of specified manufacture.

A NOVEL NAUTICAL REGISTERING APPARATUS.

For registering the course of a vessel on a globe or map, and also indicating its course, the apparatus shown herewith has been devised and patented by Pedro Samohod, of Lima, Peru (Nazarenus 145). Tubes with outwardly projecting branches extend

SAMOHOD'S NAUTICAL REGISTERING APPARATUS.

toward the bow and stern, at the bottom of the vessel, and in the main rear tube slides a rod carrying a small piston, which does not engage the walls of the tube. The two tubes are connected with a central casing from which a pipe runs upward in the vessel, and a cord attached to the inner end of the rod carrying the piston extends over pulleys and up through this pipe to a connection with the hand of a speed indicator on a dial. The cord passes through and is connected with a spring-held disk in a semicircular sleeve, the spring drawing the piston forward against the action of the water flowing through the apparatus, and the piston and the indicator hand, accordingly, assuming different positions according to the speed of the vessel. Where the main forward or inlet tube enters the casing is journaled a small turbine wheel which, by means of bevel gears, drives a shaft which extends up through the pipe and operates a transmission gear connected to a ball adapted to rotate about a horizontal axis, and which supports a globe, other balls in sockets at the sides holding the globe steady.

By this means the globe is rotated as the vessel advances, and the course is indicated by a pencil or marker attached to the under side of the speed dial, but for other than a straight course the globe must be correspondingly rotated about a vertical axis, which is effected by balls engaging its sides and secured to vertical shafts adapted to be turned through a cord and pulley connection with a hand wheel, a portion of this mechanism being also connected with an adjustable pointer adjacent to the ship's compass. As an attendant turns the hand wheel, so that the pointer will remain in registry with the needle of the compass, the globe is also turned about its vertical axis, and a correct record is thus made of the voyage. To clean the casing and tubes at the bottom of the vessel, end valves in the tubes are closed and the casing is connected to a pump by which its contents are discharged. The position of the globe in relation to the marker is adjusted at the beginning of each voyage, and the record on the globe is always in view.

Speeding a Locomotive.

At sixty miles an hour the resistance of a train is four times as great as it is at thirty miles—that is, the fuel must be four times as great in the one case as it is in the other. But at sixty miles an hour this fuel must be exerted for a given distance in half the time that it is at thirty miles, so that the amount of power exerted and steam generated in a given period of time must be eight times as great at the faster speed. This means, says a contemporary, that the capacity of the boiler, cylinders, and the other parts must be greater with a corresponding addition to the weight of the machine. Obviously, therefore, if the weight per wheel, on account of the limit of weight that the rails will carry, is limited, we soon reach a point when the driving wheels and other parts cannot be further enlarged, and then we reach the maximum of speed. The nice adjustment necessary of the various parts of these immense engines may be indicated by some figures as to the work performed by these parts when the locomotive is working at high speed. Take a passenger engine on any of the big railroads. At sixty miles an hour a driving wheel five and one-half feet in diameter revolves five times every second; now, the reciprocating parts of each cylinder, including one piston rod, crosshead and connecting rod, weighing about 650 pounds, must move back and forth a distance equal to the stroke, usually two feet, every time the wheel revolves, or in a fifth of a second. It starts from a state of rest at the end of each stroke of the piston, and must acquire a velocity of thirty-two feet per second in one-twentieth of a second, and must be brought to a state of rest in the same period of time. A piston eighteen inches in diameter has an area of 54½ square inches. Steam of 150 pounds pressure per square inch would, therefore, exert a force on the piston equal to 38,175 pounds. This force is applied alternately on each side of the piston ten times in a second.—Boston Journal of Commerce.

Recent Archæological News.

Recent excavations made by the trustees of the British Museum in Cyprus give an acquaintance with what was the site of Curium, which was built on the summit of a rocky elevation "some 300 feet above the sea, and was almost inaccessible on three sides." The special feature has been the discovery of a necropolis dating from what is called the Mycenean period. In the Mycenean tombs were found primitive races of the pre-Phenician time. But other and more valuable objects have been discovered, as a sard scarab bearing the name of Khonsu—which would make its date somewhere between the years 660 and 527 B. C.; also, there was a Phenician cylinder, the date of which cannot be earlier than 600 B. C. The choicest object was a steatite scaraboid of masterly execution. Finger rings, earrings, bronze bracelets, plated with gold, a necklace of delicate workmanship, have also come to light. Some of the vases are believed to be of Grecian make.

An explorer recently found in Egypt a bronze bowl and a series of iron tools of forms quite unlike any known in Egypt, and they are thought to belong to an Assyrian armorer about 670 B. C. These tools, comprising three saws made for pulling, not pushing, one rasp, one file, several chisels and ferrules, a scoop-edged drill, two center bits, and others, are of the greatest value in the history of tools, as showing several forms of an earlier date than was thought possible. They are probably of Assyrian origin.

Recent Patent and Trade Mark Decisions.

Richardson v. Lidgen (Commissioner's Decision), 77 O. G., 153.

Abandonment.—Where a part of an application was separated from the remainder and an application was made for such part and applied for more than two years after the separation of the two, but while the first application was still pending, it is held that there was no abandonment.

Ex parte Flomerfelt (Commissioner's Decision), 76 O. G., 2,007.

Effect of Extensive Sales on Patentability.—Where the patentability of a device is not clear, extensive sales may resolve the doubt of patentability in favor of an application, but it is an unsafe criterion and must be carefully applied.

Cook v. Stover (Commissioner's Decision), 76 O. G., 2,007.

Disclaimer in Interference Proceedings.—Where a party to an interference proceeding desires to disclaim, he must enter the disclaimer in his specification.

Ex parte Bryant (Commissioner's Decision), 77 O. G., 451.

Reissue to Broaden Claims.—Where an applicant acquiesces in the limited construction put on his invention and at no time during the prosecution of his original application intimated that the invention resided in the broad device sought to be claimed in the reissue application, it is clear that the failure to make the claim in the original patent did not arise through inadvertence, accident or mistake, and the reissue must be refused.

Phelps v. Hardy v. Gotman & Stern (Commissioner's Decision), 77 O. G., 531.

Amending a Divisional Application.—In a divisional application the addition of mere details, such as braces for frame, is not objectionable, especially when such details were shown in figures of the original that were not shown in the divisional application.

Who Shall First Take Testimony in an Interference Case.—Where a party divided an application and filed a divisional application on a part thereof later, and in the meantime an interfering application was filed, the party who filed the divisional application is entitled to carry his date back to the time when he filed his original application, thus making the other party take his testimony first.

Constructive Reduction to Practice.—The filing of a complete allowable application was regarded as a constructive reduction to practice, but neither an executed application merely nor a complete application is so considered.

Loewer v. Ross (Commissioner's Decision), 76 O. G., 1,711.

Actual Reduction to Practice.—A device which showed every feature of an invention in controversy and was adapted to perform the work for which it was intended and actually did such work, although it was not commercially perfected and did not work as efficiently as later devices, is held to have been a reduction to practice.

Reissue After Intervening Rights Arise.—If it appeared that other parties were using the subject matter not claimed in a patent, a reissue to recover such matter cannot thereafter be obtained.

Sievert v. Shuman (Commissioner's Decision), 76 O. G., 1,715.

Binding Effect of a Preliminary Statement.—A preliminary statement made in an interference proceeding binds the party only in proceedings in which the same parties are involved.

Motion to Dissolve an Interference.—A motion to dissolve an interference can only be made after the declaration of interference and not while such declaration is being considered.

Ex parte Weaver (Commissioner's Decision), 76 O. G., 1,715.

Reissue to Cure a Mistake of the Patent Office.—Where an application is filed for a reissue to cure a mistake of the Patent Office, a full re-examination of the case may be made, as it would not be proper to reissue a patent when it is known that a statutory bar exists.

Jenkins v. Burke (Commissioner's Decision), 77 O. G., 972.

Impertinent Testimony in Interference Case.—Testimony relating to the character of the parties is not evidence regarding the priority of invention and it should therefore be stricken from the record.

Recalling Witness.—There is no rule against recalling a witness in a case, although it is a circumstance that may touch his credibility.

J. G. Brill Company v. Wilson (U. S. C. C., Pa.), 75 Fed., 1,002.

Street Railway Summer Cars.—The Brill patent No. 315,898, consisting mainly in the use of metal instead of wooden panels for the ends or sides in car seats has been declared void for lack of invention.

Union Switch and Signal Company v. Pennsylvania Railway Company (U. S. C. C., Pa.), 75 Fed., 1,004.

Preliminary Injunction.—Preliminary injunction should not be granted where the patents in suit have not been judicially considered and involve complicated apparatus about which experts differ radically both in matters of opinion and matters of fact, and where the question of infringement depends largely upon the construction to be given to the claims in view of the prior art.

Thomson-Houston Electric Company v. Kelsey Electric Railway Specialty Company (U. S. C. C. A., 2d), 75 Fed., 1,005.

Contributory Infringement.—An injunction against one who, by his advertisements and course of business, shows a willingness to co-operate with an infringer who may present himself, by making and selling to him a device or element of a patented combination to be used in connection with other parts obtained from a different source.

Electric Railway Trolleys.—The Vandepoele patent, No. 495,443, for an improvement in traveling contacts for electric railways, to furnish to the user of the invention a trolley stand, which is one of the elements of the combination to replace the original stand which has become broken or otherwise useless, does not constitute an infringement of the patent.

Infringement.—One who purchases the apparatus covered by the Vandepoele patent, No. 495,443, has a right, immediately thereafter, to discard the element known as the trolley stand, and purchase from another a different stand which he thinks is better suited to his purpose.

Cassidy v. Hunt (U. S. C. C., Cal.), 75 Fed., 1,012.

Fruit Drying Apparatus.—The Cassidy patent, No. 172,608, has been held valid.

Damages for Infringement in Actions at Law.—In actions at law the plaintiff can recover only for the damages he has sustained, and not defendant's profits. If the royalty is shown to have been established, it is usually taken as the measure of damages, but in the absence of an established royalty what would be a reasonable royalty must be determined, and in determining this it is proper to consider the utility and advantage of the invention over the prior art, and the profits made by the defendants may be considered in arriving at a just conclusion.

Clarke v. Pellengill v. Crancer (Commissioner's Decision), 77 O. G., 1,271.

Petition for Rehearing.—A petition presented to the commissioner asking that the examiner of interference be directed to reconsider his decision relating to priority, because such decision is a travesty on equity practice, a gross injustice, in direct contradiction of the evidence, and in excess of the powers of the examiner, is wholly unjustifiable, specially when the record discloses that the examiner acted with deliberation and apparent fairness.

The Heavens for January.

BY WILLIAM R. BROOKS, M.A., F.R.A.S.

THE SUN.

On January 1 the sun's right ascension is 18 h. 50 m. 32 s.; and its declination south of the celestial equator is 22 deg. 56 m. 45 s.

On the last day of the month its right ascension is 20 h. 58 m. 28 s.; and its declination south 17 deg. 9 m. 43 s. So, as will be seen, the sun is well started on its northward journey, being six degrees farther north than on December 21.

MERCURY.

Mercury is evening star during the early portion of the month, but its extreme southern declination renders it a somewhat difficult object to pick up with the naked eye. The most favorable time to see this shy little world, always so closely embraced by the great central orb, is on January 6. It will be on that date at its greatest elongation eastward from the sun, viz., 19 deg. 9 m. From thence Mercury sweeps rapidly toward the sun, with which it is in inferior conjunction on the morning of January 22, at 10 o'clock, when it changes to morning star.

Mercury is in conjunction with the moon on the fourth of the month at 34 minutes past noon, when the planet is only 8 minutes of arc south of the moon. It is again in conjunction with the moon on the last day of the month at 3 A. M., when Mercury will be 5 deg. 11 m. north of the moon.

On the first of the month Mercury crosses the meridian at 1 h. 23 m. in the afternon. On the last of the month at 10:58 A. M.

VENUS.

Venus is evening star, and a most glorious object it is in the southwestern heavens, soon after sunset. It is still increasing its apparent distance from the sun, as seen from the earth, and its splendor increases also throughout the month.

Venus is in conjunction with the moon on the sixth of the month at 2 h. 14 m. in the afternoon, when the planet will be 3 deg. 7 m. south of the moon.

On January 1 Venus crosses the meridian at 3 h. 0 m. in the afternoon, and on the last day of the month at 3 h. 8 m. P. M. The right ascension of Venus on the first of the month is 21 h. 47 m. 23 s.; declination south 15 deg. 10 m. 37 s.

On January 31 its right ascension is 23 h. 53 m. 27 s. and its declination south 0 deg. 34 m. 58 s. On the succeeding day Venus crosses the celestial equator. It sets on the first at 8 h. 5 m. P. M. and on the last day of the month at 9 h. 6 m. P. M.

MARS.

Mars is evening star and is at a good elevation in the eastern sky as soon as it is dark. By eight or nine o'clock good telescopic work may be done upon this interesting celestial neighbor. Although Mars passed opposition in December, when it was at its nearest approach to the earth, practically as good views may be obtained of this planet during the next few weeks as at opposition. Much remarkable detail has been detected upon Mars by the writer during the past ten days, with the 10 inch telescope of this observatory.

Mars is in conjunction with the moon on the fourteenth at 10 h. 21 m. P. M., when the planet will be 1 deg. 42 m. south of the moon. The apparent motion of Mars has been retrograde for some time, but on January 16 the planet is stationary to the west of the horns of Taurus.

On the first of the month Mars crosses the meridian at 9 h. 56 m. P M., and sets at 5 h. 35 m. the following morning. On the last of the month it sets at half past three A. M. The right ascension of Mars on January 15 is 4 h. 38 m. 19 s. and its declination north 25 deg. 9 m. 51 s.

JUPITER.

Jupiter is morning star, but it rises so early that it may be well observed by midnight. It is improving in position for telescopic study, and will be an attractive object during the early months of the year.

The following are some of the interesting phenomena of the satellites. All are observable in small telescopes. On January 1, at 11 h. 33 m. 42 s. P. M. the I satellite will disappear in eclipse. At 12 h. 1 m. 56 s. the II satellite will also disappear in eclipse. At 2 h. 54 m. morning following, the I satellite will reappear from an occultation; and at 5 h. 1 m. the II satellite will reappear from an occultation. On the morning of January 9 at 1 h. 26 m. 44 s. the I satellite will disappear in eclipse. At 2 h. 38 m. 6 s. the II satellite will disappear in eclipse. At 4 h. 41 m. the I satellite will reappear from an occultation. On January 14 at 9 h. 6 m. P. M. the III satellite will reappear from an occultation. At 10 h. 33 m. the shadow of the IV satellite will enter upon the disk of the planet, and at 3 h. 15 m. the next morning the shadow of satellite IV will pass off the disk. On January 18 at 9 h. 22 m. P. M. the shadow of the I satellite will egress; and at 10 h. 9 m. the satellite I will pass off the disk. On January 25, at 8 h. 56 m. P. M., the shadow of the I satellite will ingress; at 9 h. 36 m. the satellite I will enter in transit. At 11 h. 16 m. the shadow will egress; and at 11 h. 54 m. the satellite I itself will leave the disk of Jupiter.

On January 31, at 9 h. 10 m. the shadow of satellite IV will leave the disk. At 9 h. 42 m. the satellite IV will enter on the disk. At 1 h. 34 m. 44 s. morning following the I satellite will disappear in eclipse. At 1 h. 55 m. the egress of the IV satellite will occur. At 4 h. 23 m. the I satellite will reappear from an occultation. At 4 h. 48 m. the shadow of satellite II will ingress and at 5 h. 53 m. the II satellite itself will enter on the disk in transit.

Jupiter rises on the first of the month at 9 h. 30 m. P. M. and is on the meridian at 4 h. 3 m. the following morning. On the last day of the month it rises at 7 h. 15 m. P. M. and crosses the meridian at 1 h. 54 m. past midnight.

The right ascension of Jupiter on January 15 is 10 h. 45 m. 57 s. and its declination north 9 deg. 9 m. 28 s.

SATURN, URANUS AND NEPTUNE.

Saturn is morning star, but is not well placed for observation, especially at the beginning of the month, when it rises at 4 A. M. On the last of the month it rises at 2 h. 10 m. A. M.

Uranus is not in good position for observation. Neptune is in the eastern evening sky, its right ascension on January 15 being 5 h. 8 m. 9 s., declination north 21 deg. 28 m. 57 s.

Smith Observatory, Geneva, N. Y., December 21, 1896.

The First Daily Weather Map.

One of the important dates in meteorology, about which there has been a good deal of dispute lately, is that which marks the issue of the first daily weather map, says R. De C. Ward in Science. The credit of having been the first to publish such a map has been generally given to Le Verrier, who, on September 16, 1863, began the issue of a daily weather map in Paris. It is a fact, however, that twelve years before that, in 1851, a weather map based on observations made on the day of its publication was issued and sold in the great exhibition in England. The data for the map were collected by telegraph, and its publication was continued from August 8 to October 11, 1851, Sundays excepted. This was without doubt the first daily weather map. The September number of Symons' Meteorological Magazine contains a reproduction, about one-quarter the size of the original, of the Great Exhibition map of August 8, 1851.

The Production of British Pig Iron.

Many estimable people surveying the statistical evidence of national progress and retrogression appeared to have made up their minds that the industrial prestige of Great Britain was slowly but surely waning, because we seemed to have lost our supremacy as an iron making nation and to have yielded up our priority of position to the United States and to some extent also to Germany. To such persons it may come as an agreeable surprise to learn that the output of pig iron in Great Britain for the first half of 1896, as ascertained by the British Iron Trade Association, places us once more in the front rank as an iron producing country. Our total make of pig iron for the first half of the past year was 4,328,444 tons, which is a larger output than we have ever before attained in six months. This output, however, is not equal to that reached by the United States in the same period. With the commencement of 1896 the output of pig iron in the United States was at the rate of about 11,000,000 tons a year, but since then the output has fallen month by month, until it is estimated that it does not now exceed a rate of 6,500,000 tons a year, while the output for the twelve months, assuming the continuance of the present rate of production, has been estimated at less than 8,500,000 tons, which would, of course, be less than the British output for the same period, assuming the maintenance of the rate of output during the first six months of the year. As for Germany, which is the next largest iron producing country after Great Britain and the United States, the production up to the present time justifies the belief that the total output of pig for the year will be about 6,000,000 tons, or approximately about 2,500,000 tons under the output of the United Kingdom, from all of which it seems reasonable to expect that at the end of 1896 our own country will have fully reasserted its old supremacy.

The most striking features of the progress that has been achieved in the pig iron industry of the United Kingdom during recent years has been the increased productivity of the plant employed owing to improvements of design and methods of working that almost amount to a revolution. A quarter of a century ago there were 915 blast furnaces erected in this country, of which 688 were in operation. These 688 furnaces produced in 1871 an average output of 8,665 tons per furnace and consumed an average of nearly 2¾ tons of coal per ton of pig iron produced. In 1895 the average production of the 744 furnaces in operation in the United Kingdom was 22,700 tons, and the average consumption of coal per ton of iron produced was 1·97 tons, so that in the interval the average output per furnace had increased by about 165 per cent, and the average consumption of coal per ton of pig iron produced had been reduced by about three-quarters of a ton. Even these figures, however, do not represent the full measure of the advance that has been accomplished during this period. In some districts the progress has been much greater than in others, and the maximum of progress achieved in a few individual cases points to what might have been done in the way of still greater progress and indicates what may be expected.—London Times.

In a recent number of the Scientific American a new element lucium was described. It now appears that this element and its application to incandescent gas lighting have been patented. The patentee claims that lucium exists in monazite sand to the extent of 1·80 per cent. Evidently Berzelius, Davy and others, who gave their discoveries to the world, were not alive to their opportunities.

BLOWN GLASS BRICKS FOR BUILDING PURPOSES.

A feature of the recent Stuttgart exhibition which attracted considerable attention was a display of buildings which were constructed of what is known as the Falconnier's blown glass brick, so named after the inventor, a French gentleman. The bricks are blown hollow in the same way as a bottle, the color

FALCONNIER HOLLOW GLASS BRICK.

which is most commonly used being a very light bottle green, bottle glass being the strongest; though yellow brown or other shades of green may be used if desired. The standard brick is 5 inches wide, 8 inches long, and 4 inches thick, and is formed in the shape shown in the accompanying illustration. When it is used for walls, or such structures as have to carry a quiet load, the bricks are laid as shown in our view of an ornamental pavilion, and cement is used in the joints, which are hollow. But when the bricks are used in roof work, or where the finished work will be subjected to bending strains, the cement is assisted by winding stout wire around the joint grooves in such a way that it will pass under one brick and over the next, the course of the next wire being reversed. A similar set of wires is wound in the cross direction, so that the bricks are really set in a wire network into which they are securely cemented.

When large walls or arched roofs are made of these bricks it is necessary to make allowance for expansion, especially if the work has been done in cold weather. For this purpose the edges of the bricks are covered with a thin layer of glue, which is subsequently destroyed by the cement between the bricks and leaves sufficient space for their expansion in hot weather.

It is claimed that they are permanently translucent, and that they have the advantage over double glass windows that they do not admit damp or dusty particles, and never tarnish. The surfaces, exterior and interior, are so ribbed and curved that while abundance of light is admitted, it is impossible to see through them. On this account they may be used where an ordinary window would be objectionable, as in the case of a window that looks into those of a neighboring house. Perhaps the most valuable feature of these bricks is that the air which they contain is an excellent non-conductor of heat, and tends to keep a house cool in summer and warm in winter, and, of course, damp will find it difficult to pass through a wall built of this material. On account of its non-conductivity this material is admirably adapted to the construction of greenhouses, and it lends itself to some remarkably picturesque effects in this class of construction, the roofs being built in arched or dome-like forms. It is also used to advantage in the construction of pavilions, such as the one shown in our engraving, or of city restaurants and places of public resort, where light shall be admitted, but a view of the interior shall be impossible.

PAVILION CONSTRUCTED OF BLOWN GLASS BRICKS.

Messages by Kite Wires.

William A. Eddy, Dr. William H. Mitchell and Henry L. Allen sent the first kite telephone and telegraph message in the world over a midair wire, sustained by three large kites, on the evening of December 6, 1896, in Bayonne. Morse sounder telegraph signals were also sent by means of a battery.

The wire was carried aloft by the kites beyond three lines of trees, two roadways, one line of fire alarm telegraph wires, one line of regular telegraph wires and a house. A red lantern was attached to an end of wire passing through a pulley, held at a height of about five hundred feet, and paid out upward and beyond the intervening obstacles. When the lantern had been carried over the line of Lexington Avenue it was slowly lowered, carrying the wire with it to the earth, where Dr. Mitchell soon established ground connections at each end of the wire, when the first telephone message was received by Mr. Eddy. Dr. Mitchell's voice was heard with perfect clearness. A telegraph signal by the usual Morse sounder was also successfully transmitted. The telephone messages and telegraph signals were continued about an hour and a half. Those using the telephone were William A. Eddy, Mrs. Eddy, Henry L. Allen, George S. Bogert and F. M. Wilson, all of Bayonne. The kites were sent up at 4:30 p. m., the telephone wire at 8 p. m., and both kites and wire were drawn in by 11:30 p. m. Delay was caused by two of the lowering lanterns falling about five hundred feet, the lowering wire having broken owing to a jam in the pulley, and by the wind, which was so light from the southwest that for a time the lifting force was insufficient. Mr. Eddy says the wire can be carried across the Kill von Kull readily, especially with northerly winds.

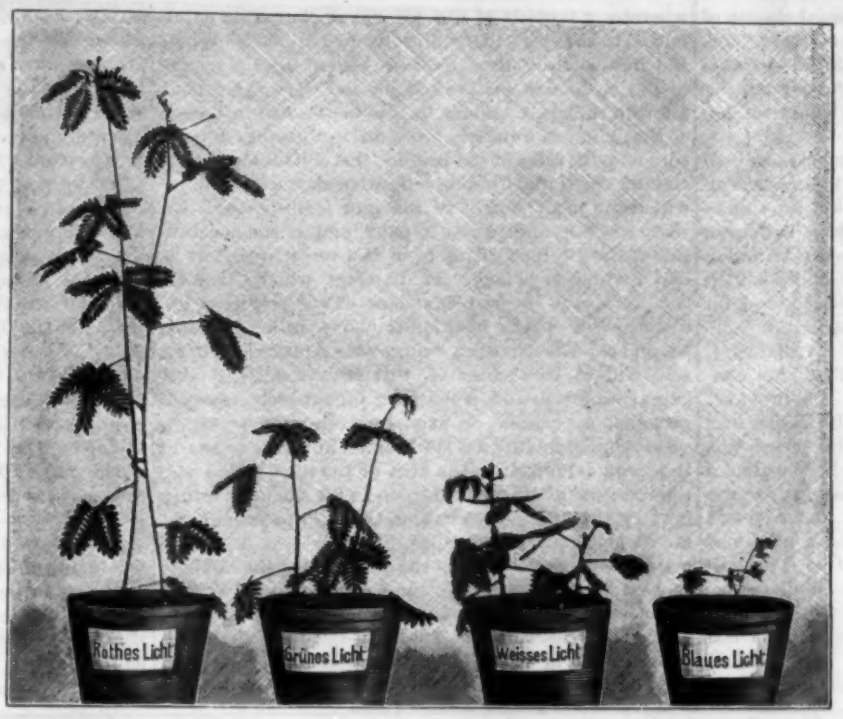
THE PHILOSOPHY OF PLANTS.

It is well known that most animal organisms need the direct influence of sunlight for their proper development, and in the same way plants and, in fact, all life on earth, depend on the action of this wonderful agent. The beautiful structure of plant cells, the study of which constitutes the most interesting part of plant biology, has never been properly understood until now; but men like Liebig and others have determined the peculiar use of the cells in the life of plants and have also included in their investigations, as of equal importance, the processes of nutrition. Present knowledge shows that plants take from the atmosphere what is needed for the formation of the cells, and also throw off useless material through the leaves. Thus carbon is taken up by the leaves, which transform, under the influence of sunlight, the carbonic acid taken from the air and through the roots into carbon and oxygen. Water and salts are also taken up by the roots of the plants.

The various ways in which the sunlight affects the leaves and blossoms, and consequently the whole development of a plant, must be considered in the study of plant physiology.

It is well known that sunlight has a decided influence on the coloring of the leaves, which look sickly and pale when the plant has only a little sunlight, whereas strong sunlight increases the amount of chlorophyl, thereby giving the leaves a richer color. Referring to the influence of sunlight, we may with propriety speak of the rays that work chemically, others which act simply as dispensers of heat, while still others are simply light rays, even though there is not actually such a division in nature. The chemical action of the sun's rays can be best understood by the wonders of photography, and we certainly cannot go astray in assuming that certain rays of the sun's spectrum also have a special influence on the plant cells, which will, doubtless, affect the plants of the different species differently, for the conditions of light and heat impress themselves clearly on the character of the plants.

Former observations have already proved that certain rays of the sun's spectrum have a harmful effect on plant organisms, while, on the other hand, others accelerate the circulation of the sap and the assimilation of nourishment, thus promoting the growth of the plant. A recent experiment made by the well known French physicist, Camillo Flammarion, at the Agricultural and Climatological Experiment Station, at Juvisy, indicates plainly the effect of different colored light upon plants, and the result is of special value, practically and theoretically, to plant physiologists and climatologists. It has been clearly shown by the various experiments that ordinary "colorless" light is represented by natural sunlight, because, when exposed only to it, health and natural growth reign. Colored light, according to the particular color used, causes either one sided acceleration or retardation of the development of the plant. In his most interesting experiment, Flammarion adopted the plan of exposing sensitive plants (Mimosa sensitiva), which he raised from seed, to different colored light. These plants are specially sensitive to the effect of light and to touch, and were, therefore, well adapted for Flammarion's experiment.



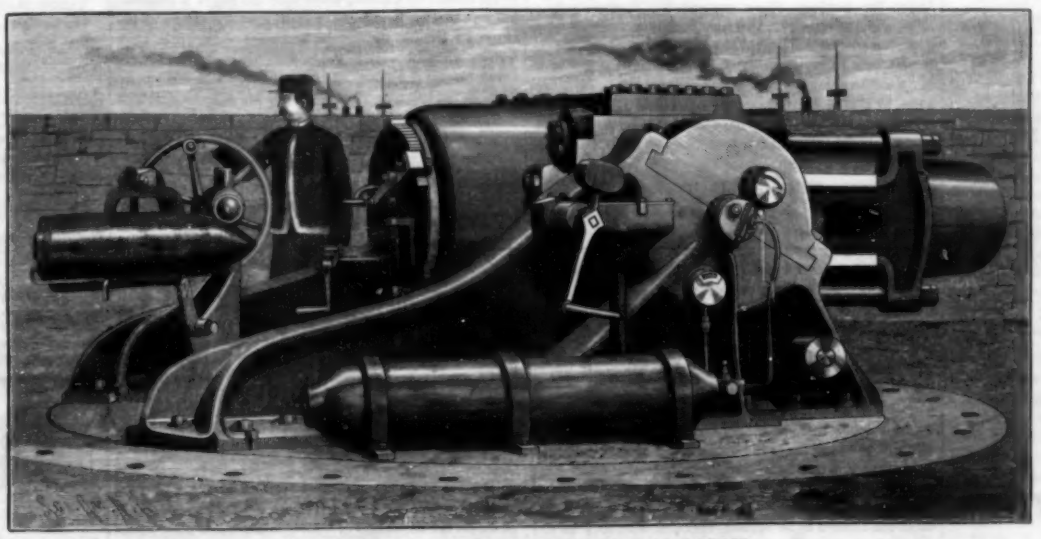
EFFECT OF DIFFERENT COLORED LIGHT RAYS UPON PLANT LIFE.

He planted a number of seeds, and the seedlings, after they reached a height of about one inch, were planted in pots, in pairs, and placed in a hothouse, where each pot received the same quantity of light and an even temperature prevailed, so that the plants were subjected to the same conditions. But the experimenter placed over some of the plants bells of green, red or blue glass, while others received the sunlight through the plain glass of the hothouse window. The effect of the colored light was soon perceptible in the development of the plants, and the more they developed the plainer this difference became, until, at the end of two months, the plants under the red glass were 16 inches high, those under the green glass measured only 5 inches, and those under the blue glass were only 1 inch high, while the plants that had been left in the "colorless" light were 4 inches high. The accompanying engraving is a reproduction of a photograph of these plants.

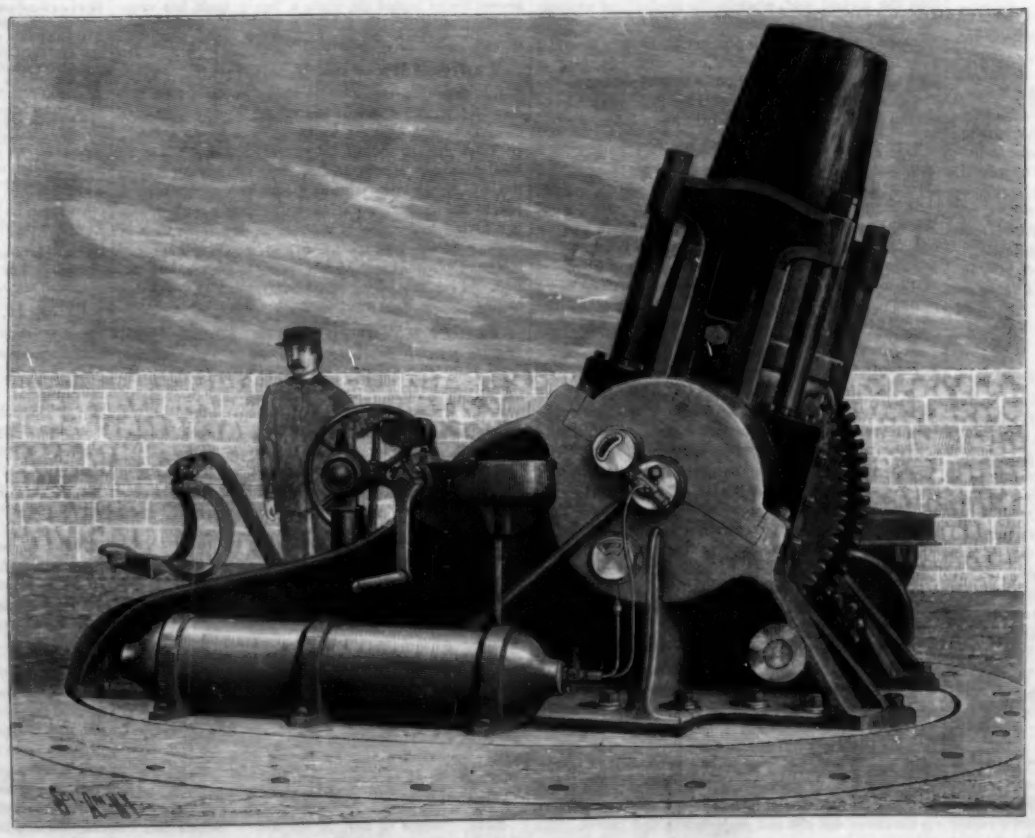
The red light forced the plants most, for those subjected to it blossomed five weeks after the seeds were planted, and the stems were much longer than the stems of the other plants. The difference between them and those exposed to the blue light was most marked. The leaves of the latter were, indeed, dark green, while the leaves of those subjected to the red light were pale, poor in chlorophyl, but the plants themselves seemed unhealthy and stunted; they had gained nothing in height since they were placed under the blue glass. Therefore, it was proved that the blue light was not only an impediment, but an actual injury to vegetation. The effect of the red light was noticeable, not only in the growth of the plants, but also in their sensitiveness, for even the slightest touch, a breath, was sufficient to cause the leaves to close and the little stems to droop. The plants exposed only to white light were not so easily affected, and those raised under blue glass were not at all sensitive. Those raised under white light must be considered normal. They were more stocky and showed a greater tendency to bud, but the buds did not open.

Flammarion extended his experiments to other kinds of plants, such as geraniums, strawberries, etc., but in all cases blue light proved injurious to vegetation, and plants that were exposed to its influence for months showed no development. All the functions of the plant organism seemed to be suspended. The fruit of strawberry plants developed under bells of different colors, but varied considerably in size and quality, as in some cases the leaves were developed at the expense of the fruit, and in other cases, as when the plants were exposed to blue light, growth was impeded in every way.

By making these investigations Flammarion has given an impulse to the study of the subject, and new results will be obtained which will be of practical use in gardening and the propagation of plants.—Der Stein der Weisen.



MORTAR IN THE LOADING POSITION.



MORTAR ELEVATED FOR FIRING.

COMPRESSED AIR RECOIL CYLINDERS FOR HEAVY MORTARS.

Despite the theoretical drawbacks attendant upon the use of compressed air, it has features which

render its use desirable for certain special classes of work. We present in this issue cuts of a heavy mortar, whose recoil cylinders are designed to be operated by compressed air. The design was worked out by Mr. H. A. Spilier, of Boston, Mass., to whom we are indebted for the particulars.

The carriage consists of a lower and upper racer bed, the upper circular bed supporting the two cheeks of the carriage, which are secured in position by a cross key 3 inch by 1 inch and eighteen 1·5 inch bolts in each cheek. These cheeks are provided with trunnion bearings with caps 30 inches in diameter and 6·5 inch face, for the reception of the trunnions formed on plates connecting in pairs the recoil cylinders.

The four recoil cylinders, 8·5 inches in diameter, are arranged in pairs on each side. They are connected by plates 2·5 inches thick and are provided with horizontal ways 7 inches wide on the sliding face between the cylinders and frames, having crossheads in which the outer ends of the hollow piston rods are secured, and they also carry trunnion bearings for the reception of the trunnions of the mortar. At each end of the lower recoil cylinders is a 1·5 inch pipe connected to same for equalizing the pressure. The hollow piston rods, four in number, 4·5 inches in diameter, extend rearward from lugs on the sliding frame through especially prepared packed glands in the heads of the recoil cylinders, and they are provided with conical valve rods, 2 inches in diameter at the large end, whereby a portion of the air below the piston is admitted to the space above the chambered heads. When the gun is fired, the recoil is taken up by means of the cushion of compressed air, and the arrangement allows a sufficient amount to pass to the forward ends of the cylinders to nearly form an equilibrium of pressure on both sides of the pistons, thereby taking up the counter recoil and forming a positive elastic cushion by which the dead weight of the gun is supported. On these recoil cylinders cast in pairs, and on the opposite side of the 2·5 inch plate from the recoil cylinders, is cast a trunnion 30 inches in diameter which supports the plates and the two cylinders. This trunnion fits into the side cheeks mentioned above, which the mortar and recoil mechanism swings on. At the right hand side, and in the center of this trunnion, there is a gage connection and a charging pipe which may connect with a portable or fixed receiver, charged with a suitable pressure to give 750 pounds initial pressure in the recoil cylinders; as the area of the four hollow piston rods must be depended upon to lift the mortar into battery at its highest elevation, this said pressure must not be lower than 650 pounds.

During its recent test by the government the carriage showed itself to be certain and regular in its action, and its service was attended by no accident or drawback of any description. A knowledge of its merits for practical use in our sea coast fortifications can, however, only be obtained by comparing it with similar carriages which have been tested by the government. These are the carriages already adopted for service, a large number of which are now mounted in their batteries, and the Gordon mortar carriage. Either of the latter, so far as its practical manipulation for loading, elevating and traversing is concerned, differs in no essential particular from the pneumatic carriage which is the subject of this report; the comparison is therefore reduced to a consideration of the relative merits of oil and compressed air in controlling the recoil. An extended experience during many years in firing hundreds of rounds in all possible conditions of temperature and weather has shown that the former method involves the simplest possible appliances, which are easily kept in order and ready for action without strain on any part of the system except at the instant of firing. The care of the carriage and its manipulation in service require no skilled labor and involve operations easily understood by the average artillery soldier. At a test of the rapidity of fire it may be mentioned that ten rounds were fired in 23 minutes 20 seconds.

AN explosion occurred on Saturday afternoon, December 12, in the Moabit quarter of Berlin, in the house of the scientist George Isaac, who was experimenting with the manufacture of acetylene gas. Isaac and three assistants were killed. It is stated that Emperor William had intended to visit Herr Isaac's laboratory, as his experiments had attracted ths emperor's attention.

RECENTLY PATENTED INVENTIONS.

Engineering.

BOILER.—Lewis M. Barlow, Donaldsonville, La. To prevent the formation of scale in the shell, and to facilitate the discharge of impurities accumulating in the mud drum, this inventor has devised a boiler in which a stand pipe leads from the bottom of the boiler shell to the mud drum, near one end of the shell, while a feed pipe discharges into the other end of the shell, near its bottom, in a direction toward the stand pipe. In the drum are nipples leading from near its bottom to a transverse pipe extending through one end of the drum to the outside, by means of which, on the opening of a valve, the impurities in the drum are discharged.

Railway Appliances.

CAR FENDER.—Mariano Sparmo and Louis Russo, New York City. This is a fender which may be readily moved from one end of the car to the other, and is light, strong and durable. It is made in sections, and may be folded upon itself when not needed, but when brought in contact with a person or object while in folded position, the sections are released, and forward spring-controlled sections move automatically into position to pick up a person or object in the way of a moving car, transferring such obstacles from a point close to the ground to the fender, which is of basket form. The forward part of the fender on receiving a weight, has rolling connection with the ground, and, in striking a slight projection, rises sufficiently to pass over it without injury.

STREET CAR GONGS.—Thomas Kelly, New Orleans, La. This invention is for an improved device for automatically actuating car gongs while the car is in motion, the motorman sounding the gong as desired when the car is at a standstill. A lever is vibrated by a projection on the car axle, the lever being connected with a striker and the latter being also connected with a foot piece under the control of the motorman, while a spring yieldingly connects the several parts.

Electrical.

ELECTRIC RAILWAY.—Andrew C. O'Connor, Lynn, Mass. According to this improvement, positive and negative conductors are carried overhead on insulated supports, whereby the current is conveyed from the power station to and from the car motor without employing the ground as a conductor. Poles on opposite sides of the track support cross bars carrying the conductors, and insulated swinging arms having rollers at their lower ends are connected at their upper ends with the conductors. Supports on the top of the car carry two conducting bars adapted to engage the rollers carried by the hanging arms, the bars being insulated from each other and connected with the motor of the car. As the car moves along the bars make contact with the rollers in advance before dropping the pair already engaged at the rear

Mechanical.

COUNTERSHAFT AND BELT TIGHTENER.—Eugene C. Weston, Gallatin, Mo. According to this improvement, an independent shaft mounted in hanger bearings has rigidly connected hanger arms which support a countershaft on which are two fixed pulleys, the first shaft also carrying a rigidly connected arm on which is a segmental gear engaged by a worm on a vertical shaft supported by one of the prime hangers, there being a hand wheel on the lower end of the vertical shaft. Belt guides are arranged in connection with the pulleys on the countershaft, and the countershaft and its parts are carried upward or downward, to tighten the belts or throw the countershaft out of action, by turning the hand wheel on the vertical shaft carrying the worm. The improvement dispenses with loose pulleys and is designed to effect great saving in the wear and tear of belts.

Miscellaneous.

CLEANING SHIPS' BOTTOMS.—Charles P. Turner, New York City. A scouring brush designed to facilitate doing this work rapidly and effectively has been devised by this inventor. It comprises a casing made in sections, designed to adapt itself to the shape of the hull, and containing a flexible shaft carrying at its outer end a revolubie brush, the outermost section of the casing being connected with a rope passed around the hull on the opposite side, by means of which the brush can be drawn down along the outside of the hull and held in contact with it. The shaft is revolved by a crank or other power transmitting device provided with castern adapted to travel on the deck of the vessel.

PRODUCING ORNAMENTAL SURFACES.—Rafael J. Chavez and Charles C. Herman, Pana, Ill. For ornamenting in a selected color glass, wood, paper, metal, etc., these inventors have devised an apparatus comprising a number of furnaces, each having a burner, above which is a wire netting supporting a pigment, a hydrocarbon supply pipe discharging into the furnace above the netting. Pipes connect the furnaces with a mixing chamber above, and a receptacle connected with a mixing chamber is provided with means for supporting the material to be ornamented. When the apparatus is in operation a colored heated gas is produced in each furnace, by the burning pigments, in connection with oils and turpentine supplied from a tank, the gases passing into a chamber and settling on articles where not covered by a stencil or pattern.

LEVEL.—Thomas F. Deck, Swanton, Ohio. This level indicates horizontal and vertical positions, and the angle of deviation when placed out of horizontal position. It comprises a stock having a transverse bore and opposite concentric recesses, bearing plates seated in the bore, one of which has an annular rim engaging with the other plate, and dial plates secured in the recesses. Rollers have journal bearings in the dials and plates, and a weighted shaft having pointers on its ends is journaled on the rollers. There are transparent covers for the dials.

KILN FOR BURNING BRICKS, ETC.—Andrew Thaison, Laredo, Texas. This is an improved kiln designed to enable the operator to control the heat to insure a uniform and equal heating of the articles set in the kiln, and at the same time requiring only a small amount of fuel. It comprises an arched chamber to receive the articles to be burned, oppostie furnaces in the sides of the chamber with draught flues above their inner ends, each having branch flues opening at an angle into the arched roof, whereby the products of combustion pass upwardly and sidewise through the material to be burned, there being dampers in each branch flue and a draught flue from the arched roof of the chamber at each end, as well as a draught flue for each corner of the chamber. All draught is upward, and the water smoke readily escapes without injuring the green brick.

SHUTTER OPERATING DEVICE.—Robert H. Ireland, New York City. To facilitate opening and closing doors, shutters, gratings, etc., particularly fire shutters, according to this improvement, a bar is extended across the space closed, two sleeves sliding on the bar, and links of different lengths are each connected at one end to one of the sleeves, both links being coupled at their other ends to the same shutter, there being means for holding the sleeves against movement on the bar. The device also acts as a lock to hold the shutters in closed and open positions.

SLEIGH KNEE.—Herman and Henry Wesie, Medford, Wis. In order that the body of the sleigh may have lateral play on the knee to a limited extent, these inventors have devised a simple and inexpensive construction, applicable to any sleigh runner. The knee comprises an upper or body portion and side flanges, with a lug at each side of the center and a clamp adapted for attachment to the body of the sleigh and located on the upper central portion of the knee to have lateral movement between the lugs. The clamp has side flanges to engage the side flanges of the knee, and guide devices connected with the flanges of the clamp are controlled by stop devices on the flanges of the knee.

PENCIL SHARPENER.—Constant E. Conay, New York City. This is a device designed to remain permanently on the pencil, which, as it becomes dull, is fed toward the knife of the sharpener to renew its point, the knife being so located on the sharpener that the knife and its support form a rest for the fingers of the hand grasping the pencil. It consists of a conically tipped tube around which is a spiral slot, a sleeve traveling on the tube, while a set screw enters an opening in the sleeve and slot and projects into the pencil. The tube is also designed to protect any portion of the lead that is exposed and not actually used, thus preventing breakage.

AUXILIARY BROOM HANDLE.—Loy B. Young, Newport, Ark. To facilitate the advantageous use of a broom in cleaning ceilings, walls, etc., this inventor has devised a ready means of attaching an auxiliary handle to the ordinary handle to lengthen the latter. It consists of a clamp having semicircular bearings adapted to engage the broom handle and opposite bearings to engage a stick forming the extension handle, a thumb screw tightening the parts to firmly draw the handle and stick together.

ASH SIFTER.—John W. Fee, Chicago, Ill. This sifter has a suitable casing, in the bottom of which is a receptacle to receive the ashes, and the top being closed by a cover, while near the top is a removable cylindrical receptacle, which may be taken to the stove to receive the ashes, and which also constitutes a sifter when in place in the casing, being revolved by a crank handle extending out at one side. The cinders remain in the cylinder after the ashes are sifted out, which is effected without any escape of dust.

ATTACHING HARNESS TO VEHICLE SHAFTS.—Frederick Dickerboom, Windom, Minn. A device designed by this inventor is particularly for attaching light racing harness to the vehicle shafts, whereby the harness need comprise only the bridle and driving rein and the saddle, the attachment being connected with the saddle straps, and a portion of the device being a fixture to the straps, while another portion is made a fixture on the shafts. Attached to the thill is a body with a slot intersected by a bore, while a slotted slide is inwardly spring pressed, a spring pressed bolt stud being movable in the slot of the slide, and a buckle with a stud movable in the slot is engaged by the bolt to prevent the disengagement of the stud with the body.

EVAPORATING PAN.—Leon F. Haubtman, New Orleans, La. This patent is for one of a number of similar inventions by the same inventor, for quickly evaporating moisture from a liquor, and comprises a casing within which is an inclined evaporating plate, on the underside of which is secured a plate forming chamber to receive steam pipes, a wave-like plate being arranged over the evaporating plate, over which a blower forces heated air, while a liquor tank has communication with the upper end of the evaporating plate.

VEHICLE BRAKE.—Vardiman T. Sweeney, Springfield, Ky. This is an improvement on two formerly patented inventions of the same inventor, to simplify brakes adapted to be applied by the team in backing, and providing means for their application by hand as readily as by the team. The mechanism is such that when the vehicle is on an incline and the tongue is free to act, the brakes will be automatically applied, owing to the inclination of the tongue, due to the team in holding back. The invention also provides improved means of suspending the brake beam to take up lost motion, and for the taking up of lost motion in the chains or cables.

VEHICLE WHEEL.—Paris Richardson, Deshler, Neb. This wheel has a divisible hub, and the spokes and sectional fellies are made to press outwardly on the tire and hold it tightly bound on the felly sections. The hub is composed of two sections, one slidable on the other, the sections having parallel flanges receiving between them the inner ends of the spokes, there being a divided ring in the hub whereon the inner ends of the spokes are seated, radial bolts engaging the ring and projecting between the spokes, while clamping plates on the outer ends of the bolts rest on the hub flanges.

CHRISTMAS TREE STAND.—Henry W. Kurtz, New York City. This is a stand in which the body of the tree will be received and held in position on the base of the stand by braces grouped around the tree trunk, effectually preventing the tree from toppling over, while the attachment of the stand to the tree may be readily and quickly effected. The stand consists of base members detachably secured together in cruciform shape, and braces pivotally attached to opposite sides of the members are adapted at their free ends to be secured to the trunk of a tree by means of nails or screws. When the stand is not needed, its parts may be folded and packed in a small space.

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(7070) H. S. P. asks: What is the smallest in weight and size and economy of a plunge battery or batteries that will develop two actual horse power for 10 or 12 hours, and also the solution and metals and proportion, etc.? A. This cannot be done except by using an extravagantly large battery, because a plunge battery runs down very rapidly, the chromic acid attacking the zinc. A battery just sufficient to give 1,500 watts when fresh would at the end of 10 hours run down to perhaps 150 watts. A practical rule is to allow 12 square inches of zinc to 4 watts. The number of cells the battery should contain depends on the voltage. Then in use the battery may consume one-half of the power. The rule given will do for one or two hours probably. If for a long run, make the battery five or ten times as large. A powerful plunge battery is described and illustrated in our SUPPLEMENT, No. 792.

(7071) M. W. C. says: Salts are of two kinds, acid and neutral. The acid salts are those in which only part of the hydrogen in an acid has been replaced by a metal and reacts on acid. Why then is $NaHCo_3$ basic in quality? Is it called an acid salt as $KHSO_4$? A. Your first definition is correct and full. The fact that a salt affects test paper does not always show that it is not neutral. The general statement about such a salt as sodium carbonate would be that sodium is of so strong an alkaline reaction that its effect on litmus solution or test paper can only be masked by a strong acid. In other words, the neutrality of a salt is a question of constitution, not of reaction on test paper. $NaHCO_3$ is an acid salt.

NEW BOOKS AND PUBLICATIONS.

A TEXT BOOK ON SHADES AND SHADOWS AND PERSPECTIVE. Prepared for the use of students in technical schools. By John E. Hill. Second edition, revised and enlarged, first thousand. New York: John Wiley & Sons. London: Chapman & Hall, Ltd. 1896. Pp. 101. Plates xii. Price $2.

Perspective is always an attractive subject, and in the above work will be found shades and shadows and perspective treated a good deal from the draughtsman's and artist's standpoint, as well as from that of the mathematician. The work is clearly stated and includes numerous problems and a very liberal quantity of plates. Apparently an index is not considered necessary. It has all that is requisite in its table of contents.

A HISTORY OF ELEMENTARY MATHEMATICS, WITH HINTS ON METHODS OF TEACHING. By Florian Cajori, Ph.D. New York: The Macmillan Company. London: Macmillan & Company, Ltd. 1896. Pp. 304, viii. Price $1.50.

This excellent and most interesting work, with its very elaborate index and beautiful make up, indicates a subdivision of the subject which of late years has come into prominence; we refer to the history of education. It is an exhaustive monograph on the world's work in mathematics from the most ancient times to the present day, with examples taken from all parts of the world and all nations, and is an important contribution to that science. One especially interesting portion is the examination of the status of elementary geometry and its future.

CHARTS FOR LOW PRESSURE STEAM HEATING. FOR THE USE OF ENGINEERS, ARCHITECTS, CONTRACTORS, AND STEAM FITTERS. By J. H. Kinealy, D.E. New York: Spon & Chamberlain. London: E. & F. N. Spon. 1896. Pp. 4. Price $1.

These charts are for the purpose of giving rapid determinations of the factors of steam heating. They will be found exceedingly useful not only in final estimates, but in presenting results to possible customers on short notice.

INDEX OF INVENTIONS

For which Letters Patent of the United States were Granted

DECEMBER 15, 1896,

AND EACH BEARING THAT DATE.

[See note at end of list about copies of these patents.]

Air forcing apparatus, operating mechanism for, F. J. Mitchell 573,096
Air goods, A. A. Young 573,122
Air lock for caissons, etc., R. S. Gillespie 573,405, 573,406
Amalgamator, J. A. Rifle 573,163
Armature jack, W. A. Drysdale 573,323
Auger, earth, H. A. Brownlee 573,388
Axle box, car, S. Collins 573,391
Axle box, car, J. L. Petithomme 573,417
Axle, vehicle, J. P. Morris 573,281
Back band, adjustable spine protecting, J. P. Deadwyler 573,396
Bake pan, R. C. Snyder 573,045
Bakers' or confectioners' use, depositing apparatus for, R. Megson 573,432
Baling press, B. F. Martindale 573,023
Band cutter and feeder attachment, J. A. Lovette 573,019
Barrel hooping machine, H. U. Palmer 573,159
Barrel, metallic, I. Van Pilburg 573,092
Basket wiring mechanism, Thayer & Wheeler 573,311
Batter mixer, etc., S. H. Coombs 573,308
Battery. See Gun battery.
Bearing and hub, vehicle axle, A. E. Dain 573,304
Bed, folding, J. H. Morrison 573,027
Bedstead, extension, A. Butzer 573,390
Beer drawing apparatus, J. R. Young 573,172
Bicycle, V. Willits 573,316
Bicycle attachment, J. G. McNaughton 573,282
Bicycle, chainless change gear, J. C. Pratt 573,102
Bicycle costume, A. Silberman 573,168
Bicycle gearing, A. Monkiewicz 573,230
Bicycle holder, C. J. Ryder 573,098
Bicycle hub, W. R. Fox 572,976
Bicycle rack, H. Westphal 573,171
Bicycle snowshoe attachment, E. A. Peterson 573,094
Bicycle tool box, L. E. Hudson 572,993
Bicycles, adjustable support or rest for, G. Woolley 573,378
Bicycles, etc., pedal crank for, W. J. Valentine 573,056
Billiard table, pocket, P. M. Cunningham 573,393
Binder, J. H. Brunner 573,301
Blank furnace and burner, H. E. Auman 573,126
Blower, S. Barrow 573,195
Boiler. See Steam boiler.
Boiler, L. M. Barlow 573,195
Boiler cleaner, A. M. Lawson 573,226
Boiler furnace, E. J. & A. B. Duff 573,365
Boiling apparatus, electric, F. W. Schindler-Jenny 573,042
Bolting reels, mounting and driving, J. Hutchinson 573,413
Bonus determining device, J. H. Drobisch 573,076
Book, W. Bucksath 573,302
Book holder, M. E. Blood 573,073
Book rest for school desks, tables, etc., C. F. Haynes 573,099
Bootblack's foot rest, T. J. Pendergast 573,394
Bottle, A. P. Bliven 573,300
Bottle closing device, J. Macek 573,094
Bottle, mucilage, C. A. Biorn 573,129
Bottle, non-refillable, F. T. & J. P. Vanstrum 573,051
Bottle or jug, L. C. Webster 573,373
Bottle stopper, A. L. Bernardin 572,951
Bottle stopper, Friedman & Koelbel 573,212
Bottle stopper, F. C. Howell 573,220
Bottle stopper, J. Schumacher 573,301, 573,300
Box. See Axle box. Bicycle tool box. File box. Letter box. Music box.
Box for distributing pulverulent material, C. Oesterheld 573,032
Box lid holder, W. T. Marsh 573,156
Braiding machine, J. W. Hilton 573,411
Brake. See Car brake. Fluid pressure automatic brake. Vehicle brake.
Brake shoe, A. Brake 573,439
Brake shoe, A. A. Lindley 573,227
Brake shoe, Whitcomb & Coggin 573,252
Brake shoe, J. L. Wicks 573,376
Brick, composition for fire, K. H. Dangler 572,989
Brick or tile cutting machine, W. R. Cunningham 573,393
Brush, B. S. Baxter 573,198
Brush, collecting, E. B. Raymond 573,105
Buckle, lock, M. W. Lynch 573,092
Bung and flushing key for same, faucet, D. Beebe 573,284
Bung hole protector and funnel combined, A. Krimmel 573,333
Burner. See Incandescent burner.
Calcining furnace, A. Dauber 573,140
Calculating machine, G. W. MacKenzie et al 573,228
Camera, magazine, F. Stubbs 573,309
Can opener, Schorr & Collins 573,359
Car brake, T. Millen 573,024
Car buffer platform, railway, T. L. McKeen 573,187
Car coupling, G. Asbel 573,253
Car coupling, W. Johnson 572,999
Car coupling, C. Schleicher 573,063
Car coupling, automatic, J. J. Bolger 572,954
Car fender, D. Guarino 572,984
Car fender, W. J. Kendall 573,415
Car fender, E. E. Phinney 573,352
Car fender, Sparmo & Russo 573,242
Car fender, street, B. F. Seymour 573,434
Car gongs, actuating device for street, T. Kelly 573,224
Car replacing frog, W. A. Adams 573,380
Car ventilating window, Glover & Smith 572,979
Card embossing machine, O. C. Hale 573,407
Carpet stretcher, E. E. Hull et al 573,149
Carriage gear, C. A. Behlen 573,384
Carriage top connection, A. Krider 573,006, 573,007
Cash register, E. F. Spaulding 573,046
Casket attachment, M. Altmeyer 573,124
Centrifugal machine, J. G. Klenk 573,040
Chain, L. D. Howard 572,991
Chair. See Dental chair.
Chair fan attachment, rocking, R. Taggart 573,114
Chart, zodiacal, J. & C. Lindahl 573,091
Chin support for laying out the dead, F. R. Fales 573,178
Chlorin, apparatus for making, Sadler & Wilson 573,009
Chopper. See Cotton chopper.
Christmas tree stand, H. W. Kurtz 573,225
Chromos, mounting, P. I. Bonney 572,956
Chuck, E. H. Vogel 573,189
Churn, R. J. Force 573,400
Clamp, C. D. Pittis 573,287
Clamp for textile machinery, cloth, C. Weichelt 573,065
Cleaner. See Boiler cleaner. Tube or pipe cleaner.
Clocks, self winding mechanism for electric, C. M. Crook 573,430
Cloth cutting machine, G. Imhof 573,186
Clothes pounder, H. W. Toler 573,314
Clutch, friction, S. Brown 572,957
Coal cutting and drilling machine, combined, S. Raybould 573,237
Coffin truck, embalming table, etc., combined, W. F. Shaw 573,305
Coin holder, C. A. Webster 573,251
Column, P. Johnson 573,151
Columns, means for sinking wall or other supporting, R. S. Gillespie 573,404
Combination lock, D. J. Cable 573,136
Cooking utensil, J. K. Purinton 573,291
Corking machine vent attachment, W. O. Vilter 573,450
Cotton chopper and cultivator, D. C. Summers 573,309
Coupling. See Car coupling. Drill rod coupling. Thill coupling.
Coupling for rolls, J. F. Budke 573,303
Coupon system, credit, W. R. Gillette 572,978
Crate lid, W. H. H. Sallee 573,040
Crate, shipping, J. H. Jewett 572,998
Cultivator, T. C. Fleming 573,143
Curling iron, G. Skinner 573,112
Cutter. See Band cutter. Potato cutter.
Cutter head templet, S. J. Shimer 573,304
Cycle, skating, T. A. Marteeny 573,096
Danger signal, Harris & Benardin 573,318
Delivery receptacles, device for securing, W. H. Miller 573,341
Dental chair, A. W. Browne 573,135
Dental furnace, Schwartz & Cigrand 573,361
Die, J. J. Theobald 573,371
Directory, office, W. W. Powers 573,354
Door catch, F. W. Tobey 573,372
Door check, E. L. Schacht 573,300
Door closer and stop, combined, B. M. Davis 573,395
Door hanger, M. C. Richards 573,108
Drainer, cellar, W. Lee 573,014
Drill. See Grain drill. Hand drill.
Drill rod coupling, J. T. Moran 573,435
Drum, E. Boulanger 573,320
Dye, red, T. Sandmeyer 573,299
Dyeing apparatus, H. A. Metz 573,229
Educational appliance, H. Eckhardt 572,972
Egg tester, Smith & Landis 573,305
Election booth, C. G. Weber 573,250
Electric cable, F. Borel 573,176
Electric conductors, automatic grounding device for, G. A. Jewett 573,222
Electric furnace, M. Schindler 573,041
Electric generator, direct current dynamo, B. G. Lamme 573,009
Electric meter, T. Duncan 573,079, 573,080
Electric meter, C. Erben 573,082
Electric meter, W. D. Marks 573,021
Electricity and conduit for holding same, conductor of, A. Selkirk 573,302
Elevator attachment, E. C. Jenkins 572,996, 572,997
Embroidering machine, R. Weiss 573,119
Engine. See Gas engine. Rotary engine. Steam engine.
Engine igniter, gas, F. J. Rettig 573,296
Envelop, W. Albers 573,120
Evaporating pan, L. F. Haubtman 573,219
Fabric. See Pile fabric. Tire fabric.
Fan device and rocking chair, automatic, P. Sergeant-Kisslow 573,167
Feed water heater, W. L. Shepard 573,111
Fence post, H. Mater 573,097
Fender. See Car fender.
Fertilizers, apparatus for making, Courtney & Schwarz 572,905
File box, W. Lumley 573,030
Filter, water, J. A. & E. W. Hasenpflug 573,409
Fireproof construction, Ralph & Wright 573,127
Fish scaling device, H. W. Gremmels 572,982
Flat iron support, M. S. Thompson 573,052
Flower stand and bracket therefor, R. E. Burke 573,073
Fluid pressure automatic brake, G. Westinghouse, Jr 573,190
Fluid pressure regulating apparatus, H. F. Fuller 573,213
Fodder binder, C. A. Gordon 572,980
Folding machine, rotary, T. M. North 573,348
Form washing device, A. L. Hemphill 573,410
Furnace. See Blank furnace. Boiler furnace. Calcining furnace. Dental furnace. Electric furnace. Smoke consuming furnace.
Furnace, Peck & Patterson 573,235
Furnace grate and automatic stoker, J. G. Sanderson 573,298
Furring for buildings, metallic, J. T. McCormick 573,156
Gage. See Tympan gage.
Garment, O. Van Oostrum 573,060
Garment fastener, O. Van Oostrum ..... 573,057 to 573,059
Gas and electric fixture, combination, J. E. & W. M. Brown 573,387
Gas, consuming hydrocarbon, T. L. Willson 573,377
Gas engine, C. F. Culver 573,309
Gas generator, J. Hennessy 573,183
Gas heater, J. Carter 573,306
Gas, manufacturing carbonic acid, B. T. L. Thomson 573,053
Gas meter, J. Dodd 573,399
Gas or water switch, S. W. Garrison 573,403
Gem setting, D. W. Costigan 573,139
Generator. See Electric generator. Gas generator.
Glass, composition for, K. H. Dangler 572,988
Glass from flattening ovens, conveyor for carrying, Zeilers & Blanchard 573,318
Glove, boot, or apparel fastener, Freund & Sappey 573,401
Glove fastener, W. S. Richardson 573,168
Glove holder, E. R. Nablo 573,232
Grain binder trip mechanism, B. F. Stewart 573,048
Grain binder tying mechanism, B. F. Stewart 573,307
Grain drill, J. M. King 573,416
Grate, S. S. Roake 573,164
Grinding machine attachment, drill, J. H. Agosen 572,944
Gun battery, platoon, R. B. Potts 573,353
Gun mount, R. B. Dashiell 573,210
Hame fastener, G. C. Bostwick 573,131
Hand drill, J. McSweeney 573,231
Hand protector, C. H. Gleim 573,215
Harness, R. F. Spencer 573,306
Harrow, A. R. Troutman 573,315
Harvester bundle carrier, P. Hanson 573,086
Harvester, corn, B. Bucher 572,958
Harvester, corn, J. Dain, Jr 572,967
Harvester, corn, G. O. Houck 573,270
Harvester, corn, J. W. White 573,057
Harvester sheaf carrier, self binding, J. F. Steward 573,044
Hat and coat hook, C. P. Brand 573,132
Hat or cap, W. Jordon 573,192
Headlight, O. A. Comstock 573,177
Headlight, electric car, J. H. Neal 573,283
Head rest, G. T. Higgins 573,147
Heater. See Feed water heater. Gas heater.
Heater, G. A. Watson 573,170
Heater and purifier, combined, J. Bonar 572,955
Hedge plashing implement, J. A. Mitchell 573,343
Hinge, L. Bartelmes 573,197
Hook. See Hat or coat hook.
Household reminder, G. H. Albee 573,319
Ice cream freezer, L. D. Railsback 573,296
Ice cream mould and dipper, C. W. Harmon et al 572,987
Ice creeper, D. M. Forsyth 572,975
Ice tongs, Bird & Weston 572,992
Impact tool, J. F. Clement 573,200
Incandescent burner for fluid combustibles, E. H. C. Oehlmann 573,051
Indexer, J. W. Kea 573,136
Indicator. See Station indicator.
Indicator, W. F. Reichenbach 573,106
Indicator or signal, J. P. Coleman 573,307
Inhaler, G. W. Shelton 573,303
Insect powder duster, P. E. Hoffman 573,184
Insulator, F. M. Locke 573,093
Insulator, wall, J. J. O'Neill 573,101
Jack. See Armature jack. Shoe machine jack. Sole machine jack.
Joint. See Wire joint.
Kettle spout attachment, M. S. Kjellstrom 573,330
Keyboard, J. F. Black 572,953
Keyhole guard, J. S. Hecker 572,988
Knife. See Lathe knife.
Knitting machine, circular automatic rib, Leighton & Rice 573,275
Knitting machine, rotary, E. Vermilyea 573,063
Knockdown table, G. B. Yost 573,438
Lacing cord, J. P. Tolman 573,249
Lamp chimney protector, J. Kulcsar 573,155
Lamp, electric arc, A. C. Dobrick 573,398
Lamp, electric arc, Richter & Eschler 573,161, 573,162
Lamp, regenerative, Smith & Gordon 573,115
Lamps, wick adjuster for central draught, N. Johnson 573,223
Lantern, W. C. Homan 573,148
Lantern, tubular, C. Bergener 572,949
Lathe knife and cutter head, L. G. Merritt 573,098
Lawn sprinkler, I. H. Gingrich 573,083
Leaf spring, G. H. Williams 573,121
Leg, artificial, H. Heinecke 572,989
Lens, spectacles, or eyeglasses, A. H. Hart 573,087
Letter box, safety street, J. W. Hents 573,266
Level, T. F. Deck 573,211
Limb, artificial, E. H. Erickson 573,366
Linotype machine, G. A. Bates 572,947
Linotype machine knife attachment, P. T. Balls 573,383
Liquids, apparatus for purifying and decolorizing saccharine or other, M. Pridham 573,235
Liquids, purifying and decolorizing saccharine or other, M. Pridham 573,289, 573,290
Lock. See Combination lock. Sash lock.
Loom, G. A. Draper 573,304
Loom let off mechanism, I. E. Palmer 573,160
Loom pattern chain support, W. J. Lutton 573,279
Loom shuttle box operating mechanism, A. Lockwood 573,276
Loom temple, W. I. Stimpson 573,308
Magnet poles, attaching field, F. O. Blackwell 573,130
Magnet poles, securing field, H. G. Reist 573,107
Mail bag fastener, M. S. Cody 573,074
Malted foods, C. Rach 573,236
Mandolin, B. N. Rethey 573,357
Match receptacle, W. C. Schaper 573,422
Match safe, M. C. Russell 573,368
Matrices and apparatus for distributing same, J. W. Berri 573,190
Measuring machine, cloth, Kullberg & Brunzell 573,335
Meter. See Electric meter. Gas meter. Watt-meter.
Milk heating vat, Buch & Beiser 573,389
Mill. See Rolling mill.
Mining machine, coal, J. M. Householder 573,271
Mixer. See Batter mixer.
Mould. See Ice cream mould.
Moulding machine for forming warped or irregular surfaces, E. L. Taft 573,050
Mortising machine, wood, S. F. Tibbetts 573,312
Motor, F. Stark 573,306
Motor or engine, S. M. Balzer 573,174
Mug, shaving, Savage & Loughran 573,240
Music box, F. J. Bernard 572,950
Music box, O. P. Lochmann 573,018
Nipple holder, W. Lee 573,013
Note disk holder, O. P. Lochmann 573,017
Numbering head, O. Bartusch 573,175
Nut lock, C. T. & A. De Graffenried 573,397
Nut lock, J. Martin 573,022
Nut lock, T. Seely 573,044
Nut locks, means for unlocking, J. G. Landes 573,337
Organ reed tuning machine, C. N. Rand 573,103
Ornamental surfaces, apparatus for producing, Chaves & Herman 573,205
Overalls, etc., C. J. Raiffeisen 573,292
Pan. See Bake pan. Evaporating pan.
Pants guard and lock, combined bicycle, H. A. Rauert 573,104
Paper bag machine, Lorenz & Claussen 573,277, 573,278
Paper tube machine, Knight & Blackwell 573,004
Pattern or chart, M. E. Hall 573,408
Pencil pointer, W. E. Simonds 573,364
Piano, automatic, White & Parker 573,427
Piano resonator, F. L. Goulvin 572,981
Picks, etc., eye forming machine for, C. Rossman 573,109
Pile fabric, A. Webb et al 573,118
Pin. See Safety pin.
Pistol, magazine, P. B. Latrige 573,336
Planetarium, J. M. Chaney 573,137
Planter, potato, J. W. Underhill 573,004
Plow, W. Stephens 573,309
Pneumatic dispatch tube, C. F. Pike 573,037
Post. See Fence post.
Potato cutter, S. Mikami 573,099
Precious metals from their alkali cyanide solutions, precipitating, M. Netto 573,233
Press. See Baling press. Printing press.
Printing device, C. B. Kies 573,008
Printing machine and its tympan, sheet perfecting, L. C. Crowell 573,305
Printing machine tripping motion, S. D. Tucker 573,425
Printing press, job, H. Johnson 573,413
Projectile coating, C. Y. Wheeler 573,120
Propeller governor, Turner & Cummings 573,116
Propeller wheel, E. J. Parker 573,351
Pruning implement, Lowe & Gandee 573,339
Pulley, sling, F. Thompson 573,240
Pump, M. C. & M. C. Chapman 573,389
Pump, W. Clarkson 572,962
Pump, feed, J. Grubinski 573,085
Pump, hydraulic, W. Clarkson 572,963, 572,964
Purse, A. Kress 573,332
Radiator support, L. S. Bunker 573,259
Railway construction, electric, G. Westinghouse 573,066
Railway crossing, A. Lavoie 573,011
Railway defect cards, protector for, G. J. Fensky 573,234
Railway, electric, A. C. O'Connor 573,284
Railway, electric, A. Sprague 573,169
Railway signal, G. W. Keller 573,414
Railway station signal, A. A. Sprague 573,047
Railway switch, electric, S. A. Mustain 573,344
Railway system, electric, B. E. Osborn 573,035
Railways, safety apparatus for street or other, F. Dowd 572,971
Rake and fork, convertible, M. T. Burket 573,135
Register. See Cash register.
Registering machine, L. E. Allen 573,381
Road planer, J. C. Steele 573,243
Roller. See Shade roller.
Rolling mill, J. R. Jones 573,000
Rolling mill feed table, S. V. Huber 573,185
Rossing machine, A. E. Beals 572,948
Rotary engine, M. E. Clark 572,961
Rotary engine, Goodner & Charlton 573,179
Safety pin, Kelso & Rosenbaum 573,002
Sand blast and apparatus employed in operating by sand blasts, A. Gutmann 573,180
Sash fastener, F. E. Benedict 573,255
Sash fastener, H. S. G. Ray 573,295
Sash holder and lifter, R. H. Wheeler 573,374
Sash lift and lock, bedside, D. Fletcher 573,267
Sash lock, J. A. Newton 573,347
Sash, reversible window, F. Cramblitt 573,251
Saw guide, band, W. McBeth 573,028
Scale, weighing, W. G. Lenker 573,015
Scale, weighing, J. H. Stephens 573,307
Screen. See Window screen.
Screen, G. W. Cross 572,906
Screw holding device, J. H. Knapp 573,331
Seal, car, W. T. Gilbert 573,145
Sewing machine, Bailey & Burns 573,302
Sewing machine fan attachment, J. T. Lee 573,012
Sewing machine needle throat, W. H. Hanna 573,327
Shade holder, B. Conner 573,138
Shaft and belt tightener, counter, E. C. Weston 573,191
Shafting hanger, I. N. Hamilton 573,182
Shears, I. Dohnal 573,075
Ships' bottoms, scouring brush for cleaning, C. P. Turner 573,115
Shoe machine jack, F. E. Faancis 573,144
Shoe polishing device, E. Young 573,379
Shoe tip punching machine, H. L. Kemp 573,274
Shovel. See Steam shovel.
Sifter, J. W. Johnson 573,272
Sign, electric, F. H. Hawkins 573,088
Signal. See Danger signal. Railway signal. Railway station signal. Telephone circuit line signal.
Signaling apparatus, electric, Hersog & Wheeler 573,221
Smoke consuming furnace, G. A. Ball 573,385
Snapping tube, J. Yeater 573,004
Soap, making, L. Gottschalk 573,084
Soldering club, electric, Stotz & Schindler-Jenny 573,245
Soldering machine, can, W. J. & E. Phelps 573,035
Soldering machine, can, W. H. Smyth 573,425
Sole laying machines, pressing form for, E. E. Winkley 573,009
Sole machine jack, E. E. Winkley 573,010
Spinning mule, Meats & Dean 573,029
Sprayer or sprinkler, E. J. Meyer 573,157
Spring. See Leaf spring.
Sprinkler. See Lawn sprinkler.
Stacker, pneumatic, G. A. Anderson 573,125
Stamping machine, mail, J. H. Barr 573,128
Stand. See Flower stand.
Staple forming and driving machine, W. H. Jackson 573,329
Station indicator, M. Furst 572,977
Station indicator, railway, A. Paify 573,350
Steam boiler, W. H. Berry 573,256
Steam boiler, R. Joy 573,001
Steam engine, C. A. Backstrom 572,946
Steam engine, M. T. & M. C. Chapman 572,960
Steam engine, H. B. Halvorsen 573,216
Steam engine, single acting, H. & P. Nadig 573,030
Steam from tubs, means for conveying, J. Marshall 573,340
Steam shovel, J. Campbell 573,204
Sterilizing apparatus, G. W. Kellogg 573,273
Stock marker, D. C. Shannon 573,110
Stopper. See Bottle stopper.
Studs, buttons, etc., to wearing apparel, means for attaching, G. W. Younger 573,317
Swaging machine, J. C. Taft 573,051
Switch. See Railway switch.
Switch, E. M. Hewlett 573,146
Table. See Billiard table. Knockdown table.
Tag, S. H. Brown 573,321
Talking machine apparatus, E. H. Amet 573,071
Tally sheet and manifolding detachable sales sheet systems, holder for, A. B. Hilton 572,990
Tanning, H. Schweitzer 573,362
Tanning apparatus, E. Du Bois 573,077
Telegraph receiver, submarine, A. Piedfort 573,288
Telegraph sounder, mechanical, Alexander & Gillham 572,945
Telephone circuit line signal, Wales & Arnold 573,117
Telephone transmitter, L. W. Pullen 573,356
Telephone transmitter, F. A. Ray 573,294
Tetranitrocellulose, manufacture of solutions of, E. Bronnert 573,133
Textile stretching device, W. C. Mackinney 573,026
Theatrical structure, Dunn & Bronaugh 573,141
Thermostat, C. Burgher 573,134
Thill coupling, C. R. Jones 573,152
Tile, roofing, M. Horlocker 573,328
Tire adjuster, J. T. Taylor 573,310
Tire fabric, P. Krumscheid 573,008
Tire valve, pneumatic, W. E. Collins 573,392
Tires, tool for repairing pneumatic, D. A. Syme 573,049
Toy, jumping, P. P. Shek 573,241
Toy, sounding wheeled, Harbaugh & Rudiger 573,317
Treadle mechanism, F. Ljungstrom 573,016
Tricycle, D. M. Pfauts 573,295
Trolley pole safety device, B. H. Borreson 573,257
Trough. See Watering trough.
Trousers, bicycle, M. Aron 573,173
Truck brake connection, M. G. Hubbard, Jr 572,992
Truck, lumber, Hodell & Olson 573,269
Truck, pivotal car, McGuire & Hubbard 573,089
Tube. See Pneumatic dispatch tube. Smoking tube.
Tube or pipe cleaner, A. Jackson 572,994
Tweezers, diamond, L. A. Piaget 573,036
Tympan gage, B. McGinty 573,345
Type, means for justifying, B. L. Fairchild 572,974
Typewriting machine, G. C. Elliott 573,081
Umbrella, folding, W. O. Whitney 573,375
Valve actuating mechanism, G. Alderson 573,194
Valve, check, W. I. Miller 573,342
Valve device, gas engine, W. L. Crouch 573,322
Valve gear, engine, P. Mundt 573,100
Valve, tank, B. F. Mills 573,025
Vat. See Milk heating vat.
Vegetable cutting and grating machine, C. A. Langer 573,431
Vehicle brake, V. T. Sweeney 573,240
Vehicle, motor, G. Langer 573,010
Vehicle starter, C. Diez 572,970
Vehicle wheel, P. Richardson 573,298
Vehicle, wheeled, J. J. Kulage 573,334
Vehicles, construction and propulsion of, J. Gambetta 573,214
Vessels, construction of, R. A. Roberts 573,297
Vise, J. M. Van Meter 573,055
Walking stick and umbrella, combined, E. E. Greene 572,983
Warp compressor, D. McTaggart 573,346
Washing machine, J. H. Lawson 573,336
Washing machine, H. J. Pearmann 573,349
Water tower, Jackson & Moss 572,995
Watering trough, self, J. E. Kordick 573,005
Wattmeter, T. Duncan 573,078
Weather strip, H. W. Albright 573,193
Weighing and registering machine, Hanna & Fairman 572,986
Weighing apparatus, F. H. Richards 573,420
Weighing machine, F. H. Richards 573,418, 573,419
Weighing machine, F. E. Thompson 573,424
Weighing machine, automatic, E. G. Thomas 573,247
Well drilling machine, L. D. Ennes 572,973
Wells, method of and means for removing paraffin from oil, F. A. Flanegin 573,142
Wheel. See Propeller wheel. Vehicle wheel.
Wheel, T. B. Seibert 573,166
Winch, hoisting, F. B. Grater 573,326
Winding machine, yarn, W. R. Harris 573,268
Winding yarn from chains onto filling bobbins, machine for, Pratt & Upton 573,286
Window, T. W. Gabel 573,402
Window in shape of a ladder, safety, F. Scherrer 573,165
Window screen, adjustable, J. A. Smith 573,365
Wire joint, C. E. Brown 573,386
Wire netting, H. K. Swinscoe 573,370
Wire stretcher, woven, J. W. Hutchison 573,150
Work holding device, E. N. Gates 573,325
Wrench, J. F. Tiner 573,313
Wrench, J. E. Wood 573,070
Yarn skeins, apparatus for holding, J. T. Hammonds 572,985
Yoke center, neck, W. E. Haight 573,181

TRADE MARKS.

Ale, T. McMullen & Company 29,313
Antipyretic and analgesic preparations, A. H. Still 29,307
Bicycles, M. E. Johnson ..... 29,301 to 29,304
Butter, Belle Springs Creamery Company 29,315
Canned meats, fish, vegetables, fruits, and condensed milk, W. B. Timms 29,316
Clinical and office instruments and apparatus, H. Sanche 29,300
Dyestuffs, Farbenfabriken, vormals Fr. Bayer & Company 29,323
Food, certain named fat producing, A. Loring 29,311
Gloves and hosiery, Firm of M. S. Esche 29,297
Gum, chewing, Grove Company 29,322
Leather, Kullman, Salz & Company 29,298
Medicinal wine, A. H. Still 29,308
Medicines, laxative, Tarrant & Company 29,305
Mineral water, natural, Æsculap Bitter Water Company 29,312
Paper, linen writing, Marcus Ward & Company ..... 29,293 to 29,294
Printed publications, Burke & Beyer 29,295
Remedies, household, R. N. Dowsley 29,306
Remedy for the tobacco habit, W. J. Patterson 29,309
Soap, C. Davis & Company ..... 29,318 to 29,321
Soap, T. A. Kasey 29,317
Sugar substitute, Farbenfabriken, vormals Fr. Bayer & Company 29,314
Tabs which are attachable to wearing apparel, fastening, M. H. Mergenthaler 29,296
Toy torpedoes and toy paper caps, M. Backes' Sons 29,299
Witch hazel balsam, preparation of, C. T. Bosworth & Company 29,310
Wood fillers, C. A. Reeve & Company 29,324

DESIGNS.

Bedstead, G. Semel 26,415
Bird scarer, W. A. Taylor 26,419
Border plate, metallic, E. A. Langenbach 26,413, 26,414
Box, H. A. Deknatel 26,400
Brick, fire, A. B. Cluniee 26,403
Dish, A. A. Southwick 26,397
Exercising club, A. M. Heydrick 26,416
Eyeglass case, J. S. Spencer 26,404
Fence strand, D. C. Benjamin 26,417
Flush tank, B. M. Carney 26,409
Glass dish, J. B. Hill 26,395
Guitar body, G. Behm 26,398
Handle for pans, etc., F. L. Jack 26,401
Kitchen cabinet, W. B. Pigg 26,416
Oven shelf, A. B. Garling 26,402
Pedal foot piece, R. Janney 26,412
Pencil, lead, S. Kraus 26,396
Pillow case, A. W. Hanington 26,417
Rail splice, W. S. Patterson 26,406
Railway spike, A. Barrows 26,405
Ring, C. Knapp 26,392
Shoe welt, J. Walden 26,399
Spoon, etc., G. L. Crowell, Jr 26,393
Truck side frame, car, J. A. Brill ..... 26,405 to 26,407
Velocipede fork and crown, A. G. Moore 26,411

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